Natural Resources

Teacher's Introduction to Natural Resources

Kentucky's Rich Natural Resources Offer Many Benefits

Kentucky is rich in natural resources, with forests and farmland, wildlife and wetlands, helping to form our economic base, as well as contributing to the state's ecological uniqueness and quality of life. The way these resources are treated has changed as we have shifted from decades of exploitation to better land management policies and increased conservation efforts.

Many Kentuckians are beginning to understand the value of our state's biological diversity. Protecting the state's natural beauty and environmental quality is an important and significant challenge to all of us. It is a challenge that will inspire your students and encourage them to become better stewards of our natural resources.

ν Where To Get Information

The "State of Kentucky's Environment" report contains information regarding land management, agriculture, forestry, natural areas, fish and wildlife, and threatened and endangered species. Many easy-to-interpret charts and graphs are included, providing information specific for Kentucky and individual counties. Check the index in the report for general information and the expanded index in the Appendix of this guide to find a list of all the references to your county and region.

ϖβ Overview of Student Activities

Land Management:

Activity 1: How We Use Our Land

Students will look at statewide and local land uses and consider the impact and changes that have occurred over the years. They will further define local land use issues affecting their community and how they can promote positive change.

Agriculture:

Activity 2: Conserving Our Farmland

In this activity students will examine soil erosion issues and trends in Kentucky. Students will also evaluate what is being done to solve erosion problems and will take action to address this problem in their community.

Activity 3: Food, Pesticides, and the Environment

In this activity students will learn about the amount of agricultural pesticides used statewide and in their county. They will examine the impact pesticides and fertilizers have on the environment and identify ways to minimize our use of chemicals.

Forest Resources:

Activity 4: The Great Kentucky Forests

Students will learn more about forest resource issues and trends statewide and in their region. They will also examine the changes in forest types and whether forests are being managed in a sustainable manner.

Activity 5: Threats to Kentucky's Forests

In this activity students will investigate the threats to forest resources statewide and in their region. They will learn about the impact of environmental problems on forest resources, the necessity of forest protection, and how they can become part of the solution.

Natural Areas:

Activity 6: **Kentucky's Endangered Wetlands**

Students will track trends in regard to the state's wetlands and learn about the threats posed to these valuable resources. They will also identify the wetlands that are threatened in their region, and what they can do to protect them.

Activity 7: The Land That Breathes

In this activity students will to learn about Kentucky's outstanding cave resources and the problems caves are experiencing due to pollution.

Teacher's Introduction continued

Fish and Wildlife and Threatened and Endangered Species

Activity 8: Kentucky's Wild Species

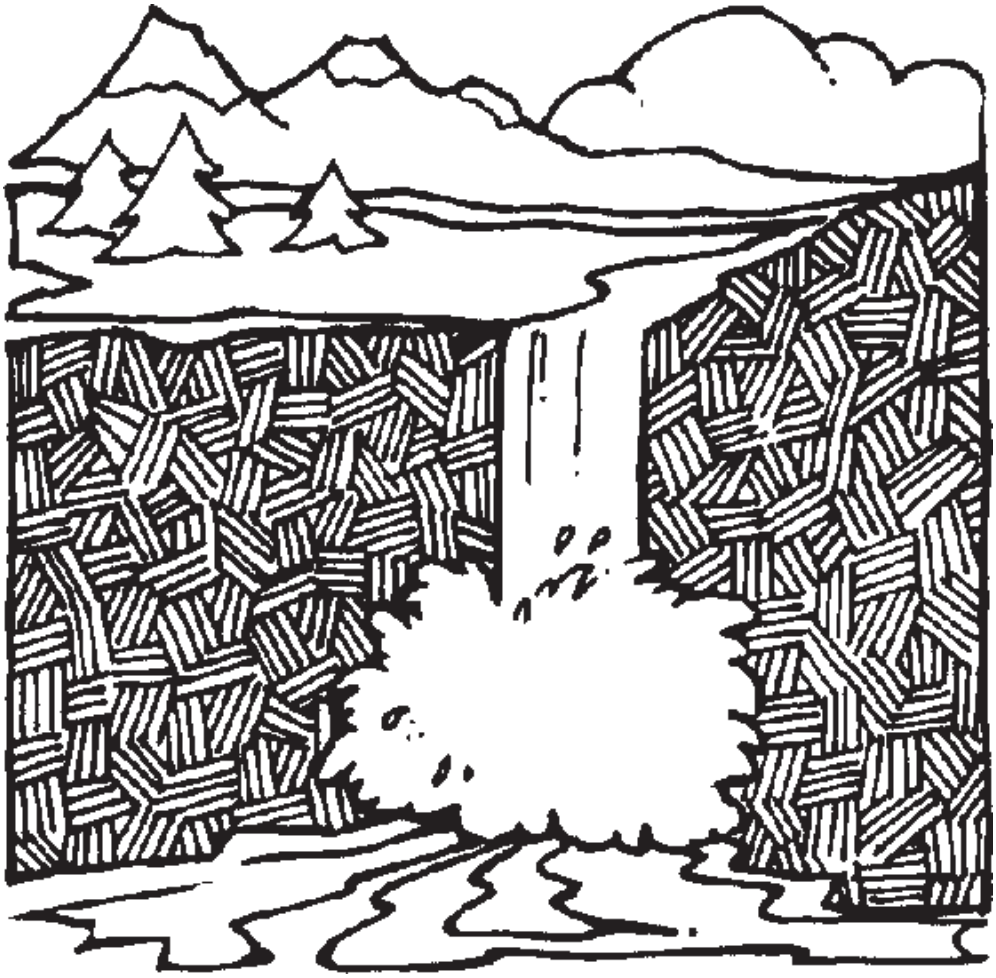
Students will investigate the problems facing wildlife and other species in Kentucky, including the impact of habitat loss and pollution. They will also learn about ongoing efforts to protect and enhance Kentucky's diverse species and what they can do to help.

Activity 9: Birds of Kentucky

In this activity students will analyze statewide trends in bird populations, many of which are in decline. Students will investigate statewide and local bird species and consider the habitat problems facing them today.

Activity 10: For Future Generations

This activity will review efforts to restore the river otter in Kentucky. Students will design a campaign, lesson, or exhibit on the river otter and the River Otter Restoration Program to help raise public awareness about the program. This activity will enable the student to play an important role in building support for the river otter and its restoration in our state.



Activity 1. How We Use Our Land

Instruction Sheet

DO YOU KNOW...

P How Kentucky's landscape has changed during the last 200 years?

P What some communities are doing to manage growth so adverse impacts are minimized?

P Who makes decisions about how land in your community will be developed?

Land Use Plays Important Role in Determining Environmental Quality

Imagine waking up tomorrow morning only to find that your favorite camping spot has been developed into a subdivision. Unthinkable - well, maybe not. Kentuckians are becoming increasingly concerned about the impact of land use activities can have on our environment and the unique character of our communities.

For example, residents in Fayette County are debating whether they should support the expansion of Paris Pike to a four-lane road. The expansion will destroy historic stone fences built along the road many years ago. In Jessamine County residents are concerned about the development of a sewage treatment plant along a pristine stream that contains many rare plants and animals. In Jefferson County, subdivisions and a golf course along Floyd's Fork are draining the creek and polluting the water. In Lyon County, citizens have rallied against a proposed chip mill that they claim will clear forests within a 75-mile radius of the proposed plant.

Land use issues affect us all, in every community across Kentucky. How we address these issues will determine the condition of our environment and community for years to come. Several Kentucky communities are actively working to protect their outstanding natural qualities in concert with economic development.

It is important to become more aware of land use issues and needs in our community and work together to make sure we pass on a clean and healthy environment to the next generation of Kentuckians.

P Purpose:

In this activity you will look at statewide and local land uses and consider the impact and changes that have occurred over the years. You will further determine the local land use issues affecting your community and how you can promote positive changes.

P Procedure:

(Note to teacher: There is a color-coded map showing land use changes that occurred in Kentucky between 1793 and 1993 to accompany this activity. The color-coding for "wetlands" and "waterbodies" may be difficult to distinguish. In general, the "waterbodies" in the 1773 map are depicted as the narrow, darker blue lines and the "wetlands" are the larger, lighter blue areas that surround them. The 1993 map shows relatively few wetlands, most of which look like small blue dots. The categories "forestland with farms" and "scarred surface area" may also be difficult to interpret in the 1993 map. The "forestland with farms" category is depicted as the large light-orange areas in the 1993 map. The "scarred surface areas" in the 1993 map -areas that have been surface mined- are the smaller orange dots noticeable in the western and eastern portions of the state. The color-coded maps are located after the instructions and worksheet for this activity.)

Part I - How Our Land is Used

1. Obtain Worksheet #1 from your teacher. Review, discuss, and answer questions.

Part II - Exploring Land Use Changes

1. As a class, discuss with your teacher the land use changes that have occurred in Kentucky between 1793 and 1993, a 200 year period. Your teacher will have a color-coded map you can refer to during your discussion. Or you can base your discussion on what you think Kentucky was like 200 years ago compared to today. Analyze the factors that likely caused the changes.
2. Suggest what the landscape might look like in the year 2193 based on they way we use our land today. Also consider what you would like Kentucky to be like 100 years from now, especially with regard to environmental quality and natural resources.

Instructions continued

Part III - Land Use and Its Impact in Your Community

1. Divide into groups and identify your community's natural resources such as rivers and streams, caves, forests, and other natural, historic, or cultural areas based on your knowledge of the area. Each group should list the following:
   A. The value of the resources you identified to people or wildlife who live there.
   B. The economic as well as the environmental value of each resource you identify. For example, if you live near a recreational lake, you should consider all the benefits good water quality has on the tourist industry, local employment, as well as the enjoyment the resource offers to local residents.
2. Research the efforts being made to protect or manage the resources you identified. Discuss and list whether you think adequate safeguards exist to protect the resources you believe are most important. Also determine who has the most control over the resources and who is responsible for preventing them from being degraded.
3. Summarize your group's findings and present them to the class. As a class, determine which resources in your community you think are the most important or in the greatest danger of being degraded or lost.

Part IV - Taking Action

1. As a class submit your findings to your local planning commission or fiscal court and elect a representative to make a presentation before them.
2. Request a response from these agencies. Further discuss the role of citizen involvement in community land use decisions.

P Other Activities:

1. Debate the pros and cons of land use planning and zoning.
2. Investigate whether you have a local land use plan. Obtain a copy if available. Summarize the major land use issues and how the county or city plans to deal with these issues in your community.
3. Divide into groups and debate a local land use issue related to environmental problems that you may be familiar with, such as siting a new landfill in your community or building a dam along a waterway.
4. Conduct a survey to determine how aware people in your school and community are of local land use policies.
5. Some Kentucky communities have established programs to set aside land for "greenspace" to protect or enhance other natural resources for the public's enjoyment. Research what is going on in your community to protect important natural areas and what you can do to participate.

P References/Additional Resources:

Many counties and cities have local land use plans. You can obtain a copy of the plan by contacting your mayor, fiscal court, or county judge/executive's office. These offices are listed in the telephone book under county or city government.

Activity 1. How We Use Our Land

Worksheet #1

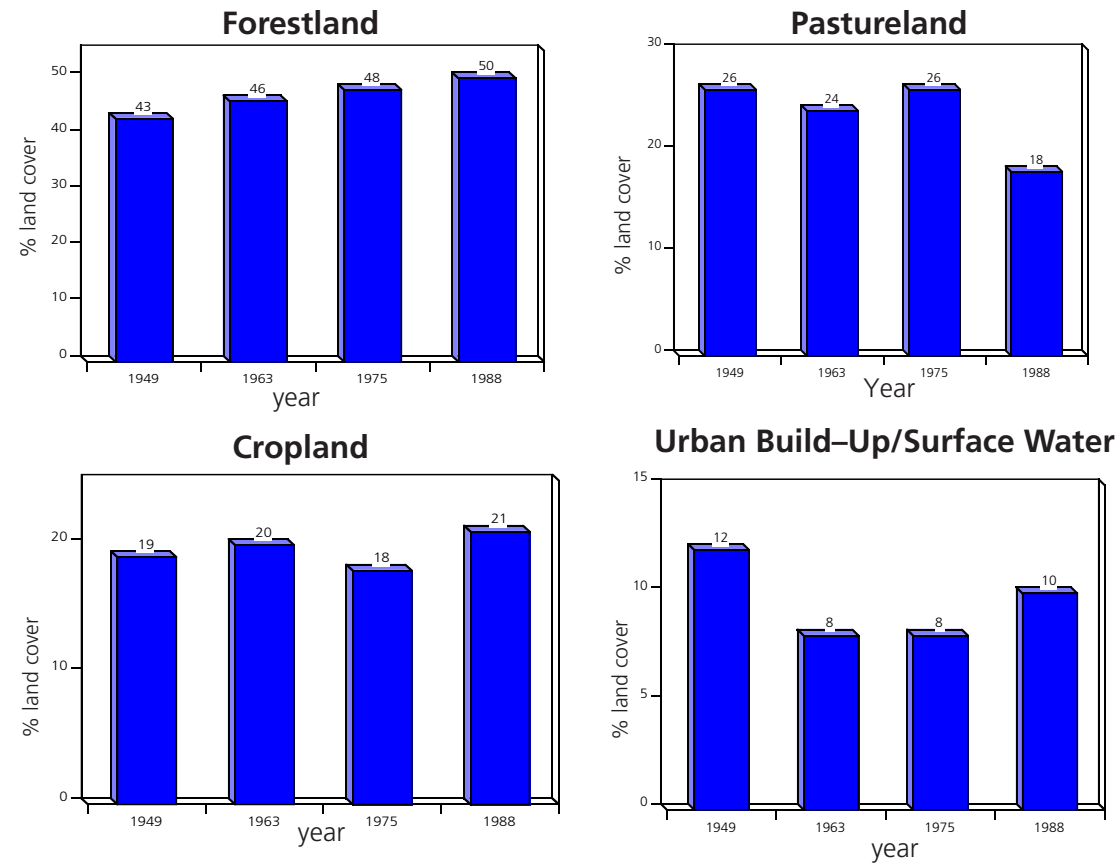
Land Use Activities Change As the State Develops

How many acres of land make up Kentucky? Well if you responded 25,800,000 acres you are correct. Our land is truly one of the greatest resources that we often take for granted. At one time Kentucky's landscape included vast forests and prairie lands filled with buffalo. Our land has changed a great deal since it was settled 200 years ago. For that matter, our landscape has also been changing during the past 40 years, as seen in Figure 1.

The changing use of land shifts back and forth among different categories. For example, old farms have reverted to forests, surface mines which have disturbed thousands of acres of forest and farmland have been reclaimed to various uses, and some pastureland has been converted to cropland. Some changes, however, are permanent such as urban build-up, roads, and the loss of land due to stream and river impoundments. While these changes are not taking place today at the rates experienced in earlier years, continuing demand for urban development, water and flood control structures, and other uses will continue to permanently alter the landscape in Kentucky.

Figure 1

Changes in Land Use in Kentucky

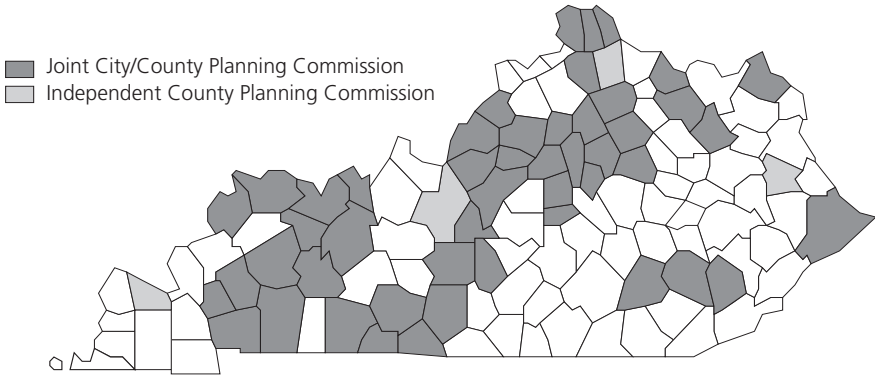


Source: U.S. Census of Agriculture, U.S. Department of Commerce, U.S. Forest Service Surveys, 1953-1988

Worksheet #1 continued

Figure 2

County and Joint City/County Planning Commissions



Independent City Planning Commissions

City	County	City	County
Columbia	Adair	Flatwoods	Greenup
Owingsville	Bath	Elizabethtown	Hardin
Middlesboro	Bell	Radcliff	Hardin
Pineville	Bell	Vine Grove	Hardin
Ashland	Boyd	Nicholasville	Jessamine
Catlettsburg	Boyd	Paintsville	Johnson
Jackson	Breathitt	Barbourville	Knox
Cloverport	Breckinridge	Whitesburg	Letcher
Hardinsburg	Breckinridge	Stanford	Lincoln
Irvington	Breckinridge	Lebanon	Marion
Morgantown	Butler	Brandenburg	Meade
Alexandria	Campbell	Muldraugh	Meade
Bellevue	Campbell	Mt. Sterling	Montgomery
Cold Spring	Campbell	Carlisle	Nicholas
Dayton	Campbell	Owenton	Owen
Ft. Thomas	Campbell	Hazard	Perry
Highland Heights	Campbell	Stanton	Powell
Newport	Campbell	Burnside	Pulaski
Wilder	Campbell	Somerset	Pulaski
Carrollton	Carroll	Russell Springs	Russell
Liberty	Casey	Campbellsville	Taylor
Burkesville	Cumberland	Elkton	Todd
Prestonsburg	Floyd	Springfield	Washington
Warsaw	Gallatin	Providence	Webster
Lancaster	Garrard	Corbin	Whitley
		Williamsburg	Whitley

Source: Kentucky Legislative Research Commission, 1987

Worksheet #1 continued

Planning Commissions Help to Balance Growth and Protection Needs

Several communities have become increasingly aware of the impact economic and residential growth have on local cultural and historic values, as well as on environmental and natural resources. Many have established county and city planning and zoning commissions to better balance growth with social and environmental factors (Figure 2).

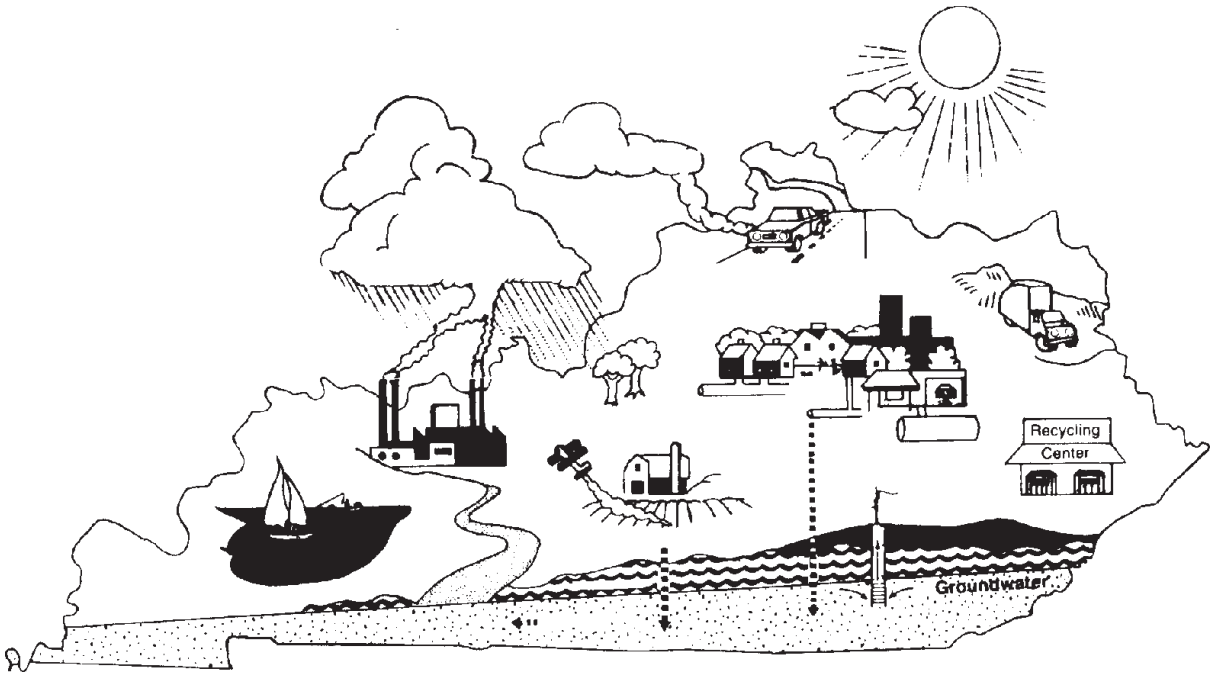
These commissions often make important decisions about land use which can make a significant difference in the environmental well-being of a community.

Most of the counties and cities with planning commissions have developed comprehensive plans and zoning ordinances to provide for growth in a balanced manner. The public is usually able to participate in the development or update of the plans which is a good opportunity to encourage efforts to protect important community resources, including the environment and our cultural heritage.

Many Communities Do Not Have Land Use Planning

Although some communities have made progress in managing land resources effectively, public resistance to governmental involvement in specifying land use is a major obstacle to the adoption of city and countywide planning and zoning in Kentucky.

For example, recent efforts to pass a planning ordinance in Montgomery County were unsuccessful due to public opposition. It is unlikely comprehensive planning and zoning will play a significant role in many rural Kentucky communities. It is therefore important to be aware and keep informed about land use changes occurring around you so you may ensure the environment and unique character of your town is protected for future generations to enjoy.



Worksheet #1 continued

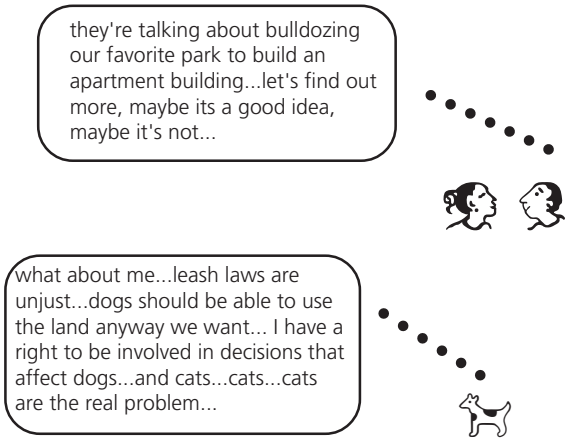
Questions?

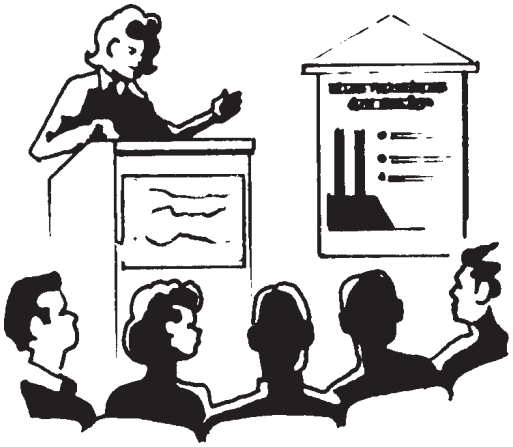
1. What land uses in Figure 1 have changed the most since 1949? The least? Why do you think this is the case?
2. Do you think these land use changes affected the environment? If so how?
3. What land use changes do you think will likely occur in your community in years to come?
4. Does your community have a planning and zoning commission?
5. What steps could you take to get involved in local land use decisions?
6. Describe what you want your community to be like in 20 years, especially with regard to environmental quality and land use.

What You Can Do...

1. Attend meetings of the local planning and zoning commission, fiscal court, or other agencies that make decisions about how land will be developed in your community.
2. Participate in the Wildflower Establishment Program which is operated by the Kentucky Transportation Cabinet, 502-564-4556. Groups and individuals can work with the Cabinet to plant wildflowers along roadsides as a way to enhance the beauty of Kentucky's landscape and reduce roadside mowing.
3. Participate in the Wild Schools Program which is operated by the Kentucky Department of Fish and Wildlife Resources. The program offers resources to school groups to establish and protect the natural resources which are important to wildlife in your community. Contact the Department at the Arnold L. Mitchell Building, #1 Game Farm Road, Frankfort, Kentucky 40601, 502-564-4336.

Get Involved...
Land use decisions affect your future!!!





Activity 2. Conserving Our Farmland

Instruction Sheet

DO YOU KNOW. . .

- What causes our rivers and streams to be muddy?
- How soil erosion affects our drinking water?
- What is being done to reduce soil erosion from farmland in Kentucky?

Soil Erosion Degrades Farmland and Water Quality

Second Street School students in Frankfort will be learning more about nature and science, but not from books. Instead they will be planting a garden. Yes, a garden. Students will study the ecosystem by getting their hands dirty. They will study everything involved in growing a plant, from plant formation and fertilization needs, to harvesting their crops. It is all part of "Project Green Thumb" a new way to look at the importance of math and science in the production of food in our backyards and by commercial farmers.

Well maybe your class is not as lucky as the Second Street School, however, the cultivation of food is certainly important to us all. Most of the time we do not think about where our food comes from when we buy an apple or bit into a hamburger. But we should. For example, you probably did not know that Kentucky ranks 4th in the nation in number of farms. And you also probably do not know that soil erosion from cropland and livestock waste is polluting our streams and rivers.

It is important we understand the role of agriculture in Kentucky's economy as well as its importance in supplying the food for the world. We should continue to improve our ability to produce food in an environmentally sound manner.

Purpose:

This activity will help you learn more about farmland conservation issues and trends in Kentucky and in your community. You will also investigate farmland soil erosion and other environmental problems that need to be addressed in your area and how you can help solve them.

Procedure:

Part I - Learning More About Agriculture and the Environment

1. Obtain Worksheet #1 from your teacher. Review, discuss, and answer questions.

Part II - Investigating Soil Erosion

This experiment allows you to demonstrate:

A. How grass and other vegetation slow soil erosion,
B. How quickly bare soil erodes,
C. How water runoff is increased by impervious surfaces.

Materials: Three large aluminum roasting pans with a shallow "V" cut in one end (run duct tape around cut edges to prevent injuries); three clear plastic wide mouth containers; two or three sprinkling cans; board or other object to support boxes at an angle; small piece of black plastic.

1. Divide into 3 groups. Each group will conduct the following experiment:
2. Prepare pans as follows:

Group A. fill one pan with a piece of sod or soil with grass growing in it;
Group B. fill one pan with bare soil, and
Group C. fill another pan with soil with some grass growing in it, but cover the majority of the surface with the black plastic symbolizing pavement on a roadway. Add to the plastic the various materials you normally see on a parking lot (trash, oil, dirt, etc.).

3. Position pans at an angle and place a clear container under the "V" of each pan. Fill the sprinkling cans with water. Sprinkle the same amount of water on each box at the same time and collect the water runoff.
4. Record how the water runs into the container. Note which pan starts to flow first and how long it takes the flow to stop. Compare the water in the jars for clarity. You may also be able to make some comparison of the amount of water collected.

Instructions continued

5. Summarize the findings of your experiment. Discuss in class the impact of soil erosion and runoff on your local waterways and what measures can be taken to control this pollution problem.

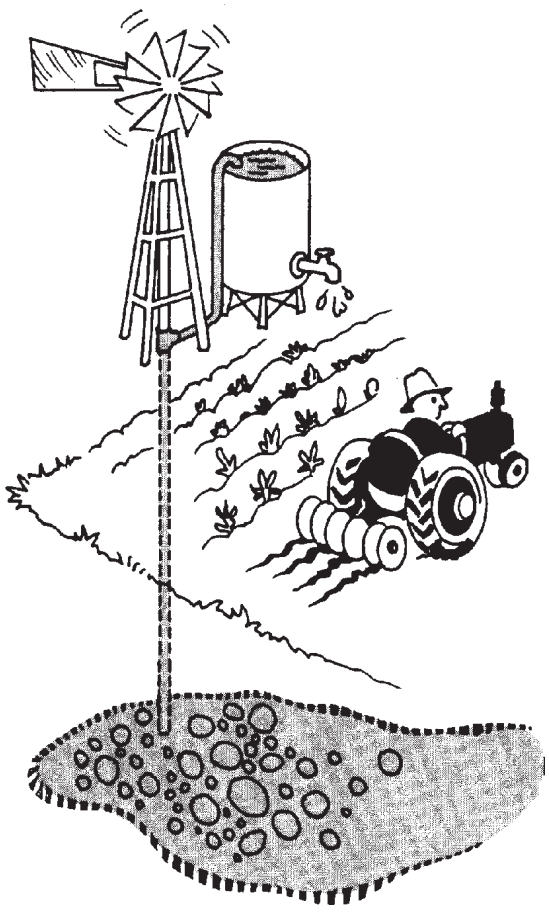
Part III - Doing Something About the Problem
1. Identify areas on the school property, a state or county roadside, a local park or other area which is eroding.
2. Determine what is causing the erosion and design a strategy to solve the problem.
3. Submit your strategy to the appropriate agency for their consideration. Ask for a response and encourage the agency to work to find a solution to the erosion problem.

Other Activities:

1. Identify drainage patterns around the school and chart how the water flows into the nearest stream or other body of water. How is the school's water runoff affecting the stream? If drainage or erosion problems exist, work with the appropriate school personnel and others to develop a plan to solve the problems.
2. Research the types of soils in your community including how soils are formed, their functions, and their vulnerability to erosion.
3. Visit a farm that practices no-till or reduced-till plowing and one that does not use either technique. Compare their operations.
4. Invite the school 4-H Club to discuss the future role of agriculture in Kentucky and related careers.
5. Read the book *Silent Spring* by Rachel Carson and summarize your reaction to this book.
6. Write a short story based on a local farmer you know.

References/Additional Resources:

1. Kentucky Department of Agriculture, Capitol Plaza Tower, 7th Floor, Frankfort, KY 40601, 502-564-4696, can provide additional information about farmlands in Kentucky.
2. Kentucky Division of Conservation, 691 Teton Trail, Frankfort, KY 40601, 502-564-3080, can provide more information regarding farmland conservation. They can also help you locate the local conservation district in your community.
3. The U.S. Soil Conservation Service has offices in every county. The offices are valuable sources of information concerning soil erosion problems and farmland conservation practices in your community. The organization is listed in the telephone book under the U.S. Government entry.
4. Part II of this activity was adapted from "Teaching Soil and Water Conservation," U.S. Department of Agriculture PA #341 (available through your local Soil Conservation office).



Activity 2. Conserving Our Farmland

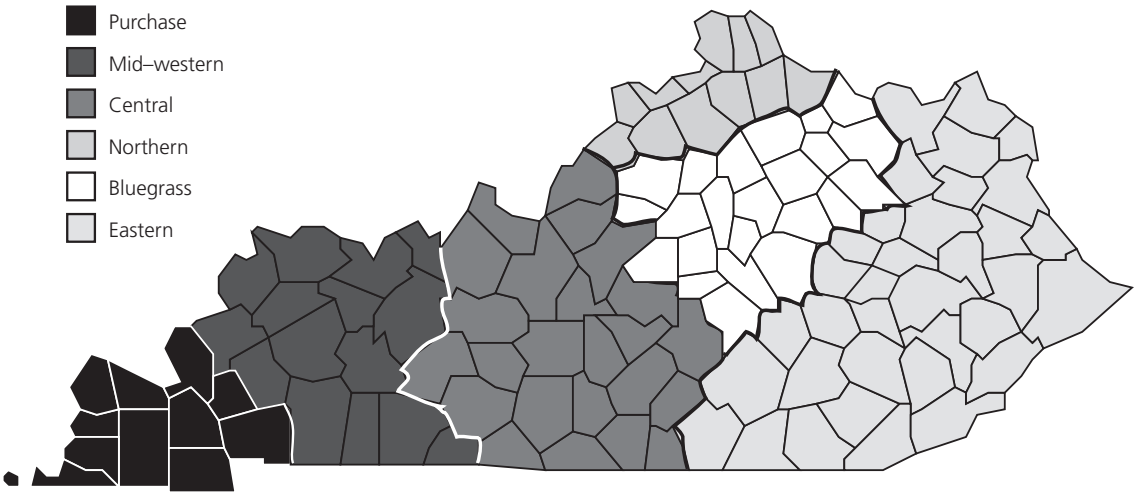
Worksheet #1

Farmland Contributes Greatly to Supplying Kentucky's and Nation's Food

Kentucky's agricultural land base produces a great variety of products and provides numerous economic benefits to the state. In 1990, for example, crop and livestock products generated $3.1 billion in the state.

Farms currently cover an estimated 50 to 55% of the land area in Kentucky. Despite a 29% decrease in farm acreage since 1929, the state still ranks fourth in the nation for number of farms (Figure 1). Generally, Western Kentucky is intensively cropped for grains, while the Central and Eastern regions of the state support a more diverse array of agricultural commodities including livestock, grain, and tobacco.

Figure 1
Distribution of Farms in Kentucky



Region	Number of Counties	Number of Farms 1959	Number of Farms 1990	Land in Farms (million acres) 1960	Land in Farms (million acres) 1990	% of Total Land Area in Farms 1990
Purchase	11	12,267	5,350	1.5	1.1	53.7
Mid–western	15	19,206	11,018	2.8	2.6	64.0
Central	24	40,194	28,589	4.4	3.8	66.0
Northern	12	11,416	8,461	1.4	1.2	72.2
Bluegrass	23	29,316	22,596	3.4	3.4	89.4
Eastern	35	38,585	16,439	3.5	2.0	24.3
Statewide	**120**	**150,984**	**92,453**	**17.0**	**14.0**	**55.2**

Source: Kentucky Agricultural Statistics, 1960, 1990

Worksheet #1 continued

Kentucky Farm Products Include Tobacco, Corn, and Cattle

While the amount of land actively used in Kentucky for crops and pasture has decreased during the last 60 years, the amount of wheat, soybeans, and other crops have actually increased. How can this be? By producing more on fewer acres of land. More intensive farming through the use of better seeds, agricultural chemicals, and the marketing of Kentucky's farm products in the U.S. and overseas has helped to make agriculture one of the leading industries in the state.

Kentucky ranks first in the nation for the production of burley tobacco and second to North Carolina for all the tobacco produced. In addition, the state ranks 11th in the nation for hay, 14th for soybean production, and 20th for winter wheat. About 47% of the farms in Kentucky also raise beef cattle. Many other products are also produced by Kentucky farmers.

Farmland Conservation Practices Protect the Environment

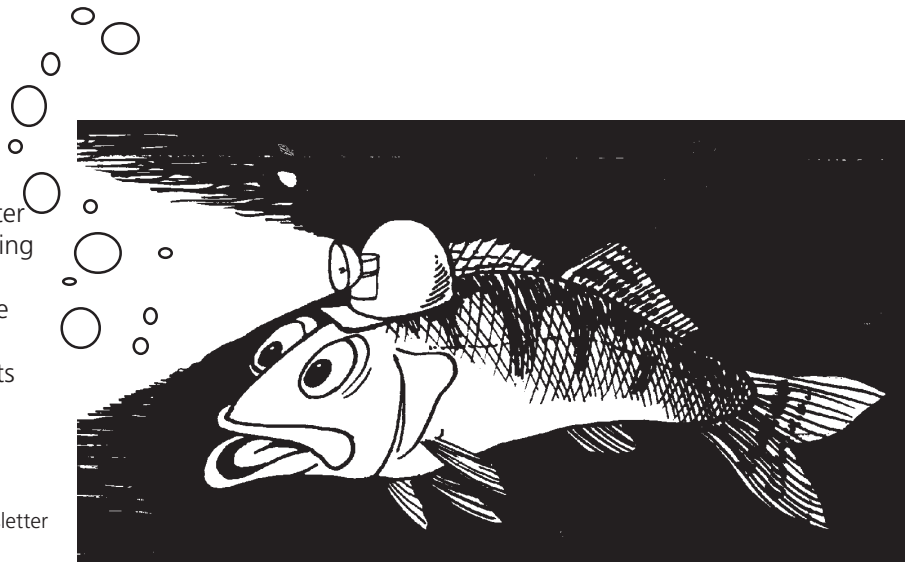
One of the greatest threats to our ability to produce high quality farm products, however, is soil erosion. Kentucky croplands currently lose an average of 8.51 tons of soil per acre each year. While we have made some progress over the past 20 years in reducing soil erosion from farmlands, the current level is still well above the tolerable annual limit of 5 tons/acre, according to agricultural experts. Some studies have shown that a six-inch reduction in topsoil can decrease average crop yields 41%. Soil erosion can also increase the cost of crop production as fertilizers and other chemicals are used to compensate for soil loss.

But erosion from farmland causes another problem. Sediment from farmland erosion causes about 30% of the water pollution found in our streams, rivers, and lakes. You may have noticed a "muddy" appearance in a lake or creek near you, especially during crop planting season or after a rain storm. The muddiness is probably due to soil eroding from farmland and other areas where there is soil disturbance that is not adequately controlled.

All this soil flowing into a waterbody also impacts fish and other forms of aquatic life adversely. Soil runoff from farmland has so greatly impacted five public lakes that they can no longer be fully used for swimming, fishing, or as drinking water supplies.

The impact of soil erosion in our waterbodies can be reduced and prevented by keeping vegetation along stream banks. Trees and other vegetation help to stabilize the stream bank and act as filter strips to reduce the amount of sediment running into the water. However, farmland is often cleared and plowed right up to the stream bank in order to increase the yield.

Many in the farming community are working to increase awareness of the benefits of leaving vegetative buffer zones along waterbodies and finding alternative sources of water for livestock.



Soil running off farmland into streams, rivers, and lakes causes water to become cloudy, or "turbid," making it difficult for fish to see and feed properly. Sediment can also damage fish gills and impair the feeding and breathing processes in aquatic insects (fish food).

Source: East River Priority Watershed Newsletter
Green Bay, WI, Spring 1990

Worksheet #1 continued

Kentucky Leads Nation in Conservation Tillage

State and federal efforts have been successful in promoting farming practices in the state that reduce soil erosion. For example, Kentucky currently leads the nation in the percentage of cropland in "conservation tillage." Conservation tillage is a farming techniques that greatly reduces soil disturbance and also helps cut energy and labor costs.

The most popular method of conservation tillage is "mulch till" in which crops are planted into the residue of previously grown crops. Another method called "no-till" involves planting the crop in unplowed soil using a mechanized planter and applying herbicides to kill existing vegetation and control weeds.

While steady progress is being made in reducing agricultural erosion, more remains to be done. The U. S. Department of Agriculture estimated in 1987 that three million acres of cropland and 669,500 acres of pastureland in Kentucky were still in need of erosion control measures. Continued local and statewide efforts are needed to reduce farmland erosion rates to tolerable limits and protect downstream areas from siltation and pollution.

Loss of Prime Farmland a Concern in Kentucky

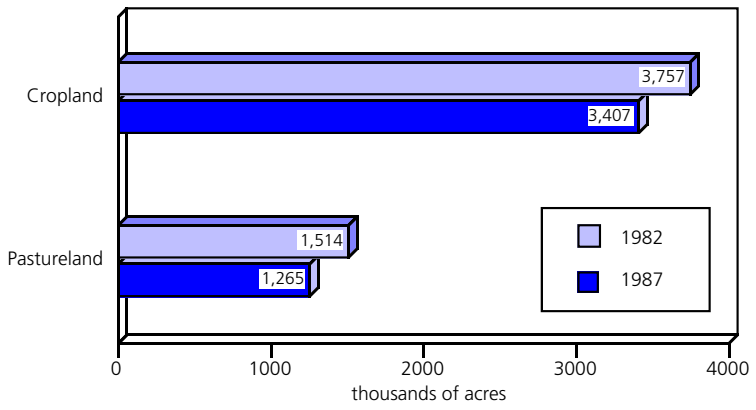
The loss of prime farmland is a continuing concern in Kentucky. Prime acres are the best lands for farming because they are flat, or gently rolling, and susceptible to little or no soil erosion. They are the state's most energy efficient acreage, producing the most food, feed, fiber, and forage with the least amount of fuel, fertilizer, and labor.

Most prime farmland is located in the Jackson Purchase and Bluegrass regions. Approximately 7% occurs in Eastern Kentucky. Prime cropland continues to be converted to other uses as can be seen in Figure 2.

In an effort to protect farmland, the state enacted the Agricultural District Act in 1982. Since then 42 counties have formed agricultural districts with 167,417 acres of farmland currently enrolled in the program (Figure 3). The advantages of participating in the districts include lower property taxes and protection from development when cities expand into rural areas. But much more needs to be done if we are to preserve and protect our prime farmland in Kentucky.

Figure 2

Prime Farmland in Kentucky



Note: 1987 data most recent available.

Source: USDA, Soil Conservation Service, National Resources Inventory, 1982–1987

Worksheet #1 continued

Figure 4
Kentucky Agricultural Districts

County	No. of Certified Districts	No. Acres
Anderson	1	675
Barren	11	5,017
Boone	8	4,646
Boyle	10	7,678
Bracken	3	5,271
Breckinridge	3	1,593
Bullitt	8	3,913
Calloway	5	3,638
Campbell	9	7,871
Carlisle	3	2,218
Christian	2	19,841
Clinton	2	1,228
Cumberland	2	3,281
Daviess	1	442
Franklin	9	11,027
Fulton	1	2,077
Grant	4	2,542
Grayson	1	342
Hardin	4	5,430
Henderson	7	10,582
Henry	1	2,186
Hickman	1	9,767
Jefferson	4	1,977
Kenton	4	4,090
Knox	2	1,599
Larue	6	5,141
Lewis	1	892
Lincoln	1	369
Logan	1	533
Marion	1	268
Martin	1	296
Mason	5	4,517
Nelson	9	4,625
Oldham	2	2,308
Russell	4	3,019
Scott	5	2,474
Shelby	4	10,461
Taylor	2	1,285
Todd	2	1,113
Wayne	1	2,679
Whitley	5	3,448
Woodford	3	10,240
Total 42	**159**	**167,417**

Note: Acreage was rounded.
Source: Kentucky Soil and Water Conservation Commission, 1991

Questions?

1. How has farming and farmland acreage in Kentucky changed since the 1920s?
2. Which region of the state has the greatest farmland acreage? Which has the least?
3. Which region had the greatest change in farmland acreage between 1960 and 1990? Why do you think this has occurred?
4. How do you think soil erosion from farmlands impacts your community?
5. Calculate the total tons of soil eroded each year from Kentucky farmlands using the average annual erosion rate and the total acreage in farmland discussed earlier in Worksheet #1.
6. What is being done to control soil erosion in Kentucky? Do you think more needs to be done? If so, what would you propose?
7. Has your county formed a Agriculture Conservation District? Why do you think it is important that we preserve prime farmland?
8. Based on the rate of change that has occurred in the total land acreage used for farming and the number of farms in Kentucky, project and show the total acreage of farms and the number of farms that would exist on your 50th birthday.

What You Can Do...

1. Start a public awareness campaign to educate your community about the importance of maintaining vegetation strips along the banks of waterways to help filter runoff pollution from farmland, coal mining, construction, and other activities.
2. Organize a tree planting project with local officials, civic groups, other classes, and the general public. Plant trees in areas where erosion is a problem, especially along river and stream banks. City or county-owned property is a good place to start. Be sure to have permission and watch over the trees during the first year. Your Conservation District or the Kentucky Division of Forestry, 502-564-4496 can help.
3. Report water pollution incidents to the Kentucky Environmental Response Team. Call them toll-free at 1-800-928-2380.

Activity 3. Food, Pesticides, and the Environment

Instruction Sheet

DO YOU KNOW. . .

- How the use of pesticides and other agricultural chemicals affect the environment?
- What some farmers are doing to reduce their use of chemicals to protect water resources and preserve farmland?
- Where your fruits and vegetables come from?

Concern About Agricultural Chemicals Increasing Among Farmers and Public

It was a sunny Saturday in mid-November. "A great day for a football game," said Steve Coleman. But Steve and his fellow workers were going to miss the game. Instead they were in Marshall County to collect old unused pesticides as part of a project that offered farmers a chance to dispose unwanted chemicals safely and at no charge.

During the two days that free collection was offered, more than 90 pickup trucks and cars brought 5,400 gallons of unused farm pesticides for disposal. Some of these pesticides are so toxic they were banned from use by the federal government because of the damage they could cause to public health and the environment.

The use of pesticides and herbicides is important in the production of food. But they can also greatly impact our environment and health if not used and disposed of properly. It is important that we do our part and find ways to minimize the use of chemicals on our land and in our food. And it is also up to us to buy food produced by Kentucky farmers. This helps our farmers and reduces the energy and costs associated with shipping food here from other states and countries.

Purpose:

In this activity you will learn about pesticide and fertilizer use in the state and its role in the production of food. You will also consider ways to reduce pesticides used in your home, school, and community and how we can create new markets for Kentucky-produced farm products.

Procedure:

Part I - The Role of Pesticides in Kentucky

1. Obtain Worksheet #1 from your teacher. Review, discuss, and answer questions.
2. Have a general class discussion about the advantages and disadvantages of using pesticides and other chemicals in our society.

Part II - Beginning at Home

1. Make a list of all the pesticides used in your home for lawn care, bug control, etc. Read the label of each and record whether the product is harmful to people, animals, or the environment. Research "environmentally friendly" ways to control pests and maintain your lawn and garden.
2. Present your findings to the class. As a class compile a list of "environmentally friendly" alternatives and create a brochure to share your findings with your schoolmates, family, and friends.

Part III - Promoting Home Grown Kentucky Products

1. Research where the vegetables, fruits, and meats you buy at the grocery store come from and whether they are grown in Kentucky. Consuming locally grown food is a great way to help reduce the amount of energy it takes to distribute food. Buying locally grown food also supports our economy and Kentucky farmers.
2. As a class discuss ways to promote Kentucky farm products in your area.
3. Present your findings to local officials and/or grocery store managers and ask for a response.

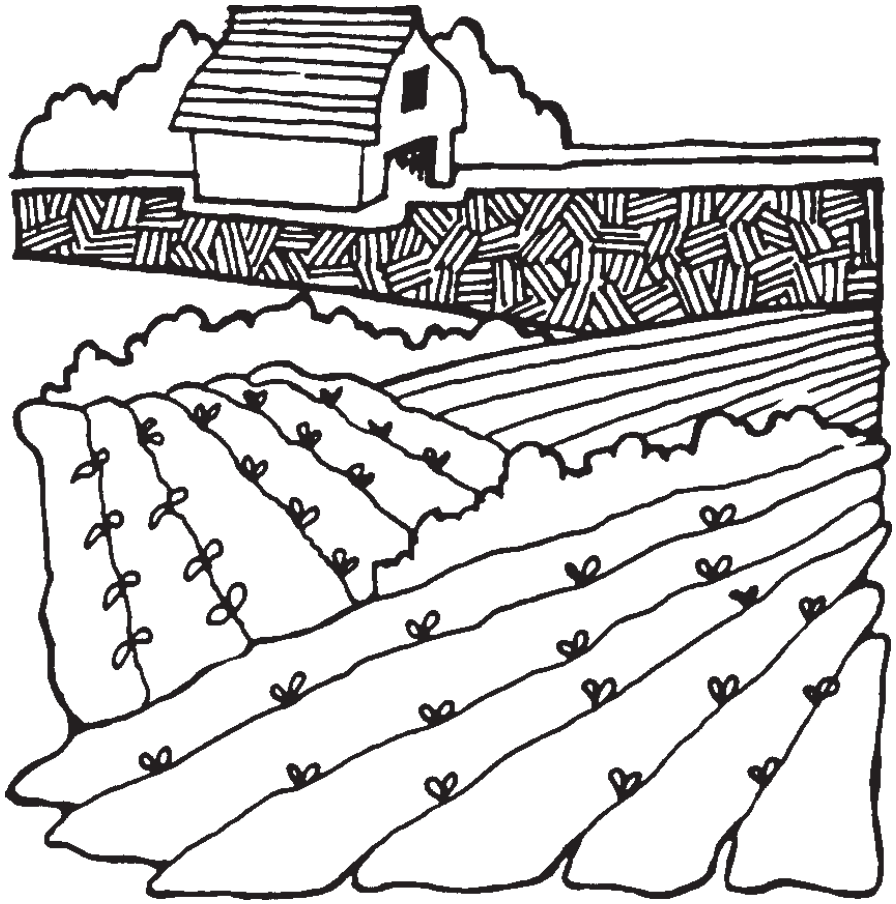
Other Activities:

1. Research organic gardening and start a small organic flower or vegetable garden plot at school.
2. Research state and federal laws that were established to protect the public from unsafe pesticide residues in food. Assess how effective these laws have been.

Instructions continued

References/Additional Resources:

1. The University of Kentucky, Research and Education Center, P.O. Box 469, Princeton, KY 42445, can provide information regarding ways to reduce the use of pesticides and fertilizers used on farmland. The Center can be reached by calling 502-365-7541.
2. The Kentucky Division of Pesticides, Capital Plaza Tower, 7th Floor, 500 Mero St., Frankfort, KY 40601, will test water wells for agricultural chemicals if contamination is suspected. The Division also has guidelines for preventing groundwater pollution caused by agricultural chemicals. For more information, contact the Division at 502-564-7274.



Activity 3. Food, Pesticides, and the Environment
Worksheet #1

Nine Million Pounds of Pesticides Sold Annually For Agriculture, Impact Not Well Known

Pesticides and fertilizers are widely used in Kentucky to increase crop production and to create the picture-perfect lawn (Figure 1). More than nine million pounds of active pesticide ingredients were sold in Kentucky for agricultural use during 1990 alone (Figure 2). Herbicides, which are pesticides used to control weeds, represented 74% of the total pesticides sold. Atrazine, the active ingredient in many herbicides, is the leading agricultural chemical in the state. This chemical is widely used to control weeds in corn.

In the past, pesticide manufacturers developed "persistent" pesticides that did not readily decompose after they were applied. However, concern about the long-term environmental and health effects resulting from these pesticides, such as DDT which is now banned, has led to the development of pesticides that are more short-lived. These compounds are more toxic when first applied, but break down more rapidly in the environment. This helps to reduce the risk of the chemicals accumulating in the environment and ending up in the food chain.

The use of agricultural chemicals has resulted in larger yields of corn, hay, and soybeans throughout the state. However, chemicals used in farming are impacting the environment in several ways. Pesticide and nitrogen fertilizer residues remain in soils and can wash into streams or leach into the ground, thereby polluting water used for drinking, swimming, and fishing.

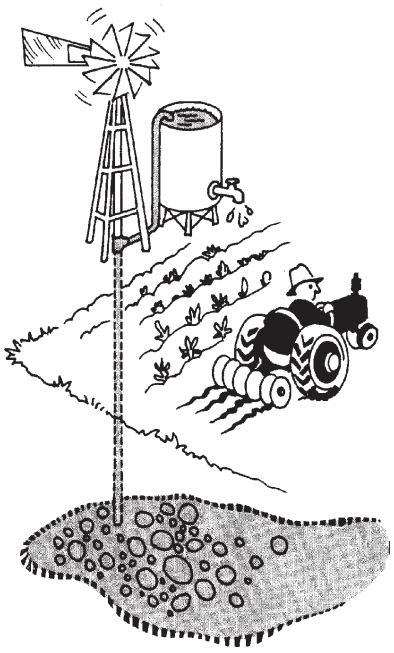
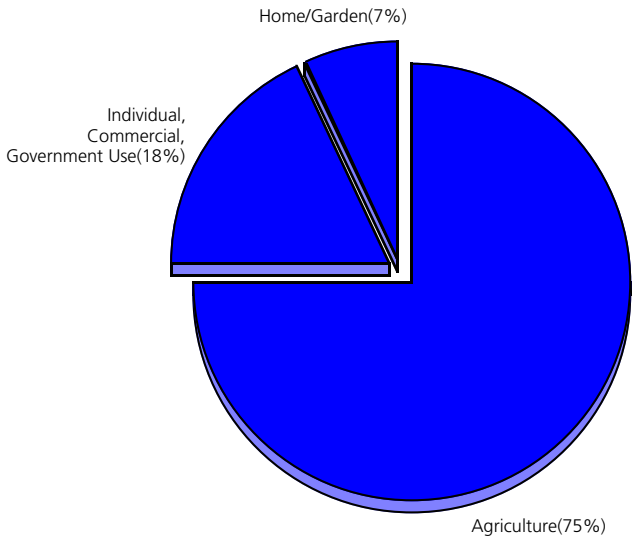


Figure 1
Estimated Pesticide Use in The United States



Source: U.S. Environmental Protection Agency, 1988

Some Efforts to Reduce Chemical Use Underway

Concern about the human health and ecological impact of agricultural chemicals has increased interest in reducing chemical use to the lowest possible levels. Alternatives to pesticides such as biological controls (using insects, viruses, etc.) are also being researched to control diseases and pests. Some farmers have reduced the use of chemicals by applying them only when necessary, rotating crops, and other measures. Advocates of reducing the use of agricultural chemicals contend that pesticide and fertilizer use could be reduced and still produce comparable crop yields. They see reducing chemical use as an opportunity to safeguard the environment and improve our health. They also note that it could save money in light of the fact that Kentucky farmers spend an estimated $52 million for agricultural chemicals each year.

Worksheet #1 continued

The level of environmental contamination from agricultural chemicals has not been thoroughly determined in Kentucky, even though half of the state's land area is farmland and many rural Kentuckians depend upon underground sources of water for their drinking water. In 1990 the Kentucky General Assembly mandated that more be done to determine the impact of agricultural chemicals, especially in our water. Early results of testing projects show pesticides and fertilizers are present in most of the streams, springs, and private water wells sampled although levels generally did not exceed levels set to protect public health.

Nitrates From Fertilizers and Animal Waste Cause Water Quality Problems

Soil runoff containing pesticide and nitrogen fertilizer residues can impact water quality. These chemicals are a serious concern in private water wells in Kentucky because these chemicals seep into the groundwater and end up in drinking water wells. Ingested at elevated levels, these chemicals can cause human health problems such as stomach cancer.

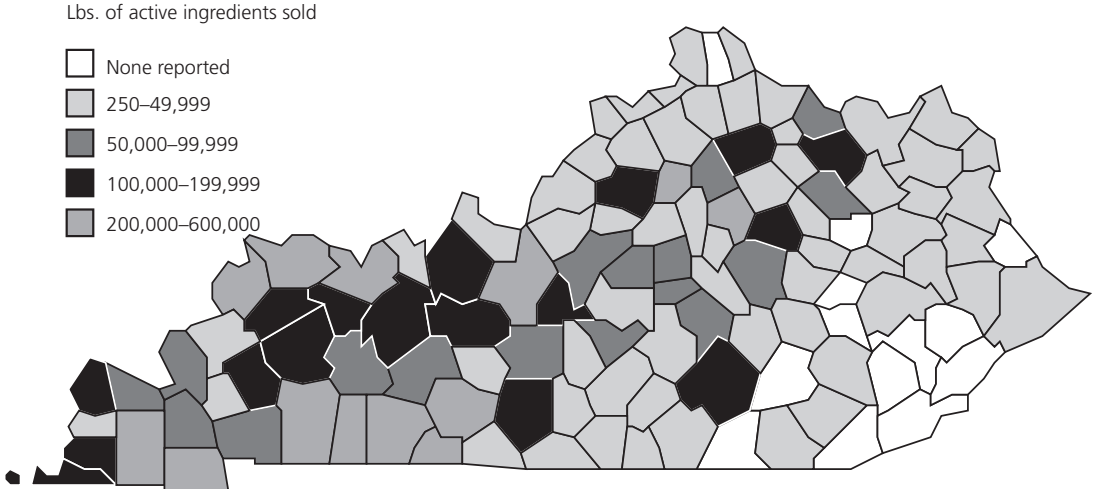
Researchers at the University of Kentucky tested 888 private water wells across the state in 1989 for agricultural chemical contamination. All the samples had detectable levels of nitrates, which are found in fertilizer, and about 6% of the wells exceeded nitrate levels set to protect public health. Areas with high agricultural activity often had a relatively high percentage of wells with detectable levels of nitrates and pesticides, especially atrazine, a common pesticide used to control weeds in corn.

Careful Attention To Chemical Application Helps Reduce Use

Some efforts have been made to promote the reduction of pesticides and fertilizers. One initiative, the Integrated Pest Management (IPM) program, provides farmers with insect, weed, and disease management information, coupled with a soil testing and fertilizer use recommendations.

The IPM program, operated by the Extension Service at the University of Kentucky, encourages farmers to apply pesticides and fertilizers only when needed. This is accomplished through weekly scouting of fields, notification of current or pending problems, control procedures, updated chemical recommendations, soil samples, and suggestions about next season's potential pests.

Figure 2
Pesticide Sales in Kentucky (1990)



Source: Kentucky Division of Pesticides, Pesticide Sales Survey Data, 1991

Worksheet #1 continued

Home Use of Chemicals Can Also Be Reduced

Kentuckians' quest for the picture-perfect lawn has also resulted in an increase in the amount of pesticides used in urban areas. An estimated 400 lawn care companies are operating in Kentucky. A state law was passed in 1990 to ensure consumers are informed about the safe use of pesticides by these commercial lawn care companies. Companies can be fined up to $100 per violation if they do not provide customers with the following:

- ◆ Written information provided at the time of entering a contract with a lawn care company regarding the safe use and application of lawn chemicals.
- ◆ A sign be posted in the yard immediately after the treatment with a warning to stay off the grass until it is dry.
- ◆ Information about the type, amount, and concentration of chemicals used, any hazard information, and reasons for use.
- ◆ Proof of commercial applicator state certification.

You may want to consider ways to reduce the pesticides and fertilizers used at your home, school, or community. Natural ways of controlling pests are effective in many cases. Reducing chemical use will help improve the overall quality of our environment and protect our valuable water resources.

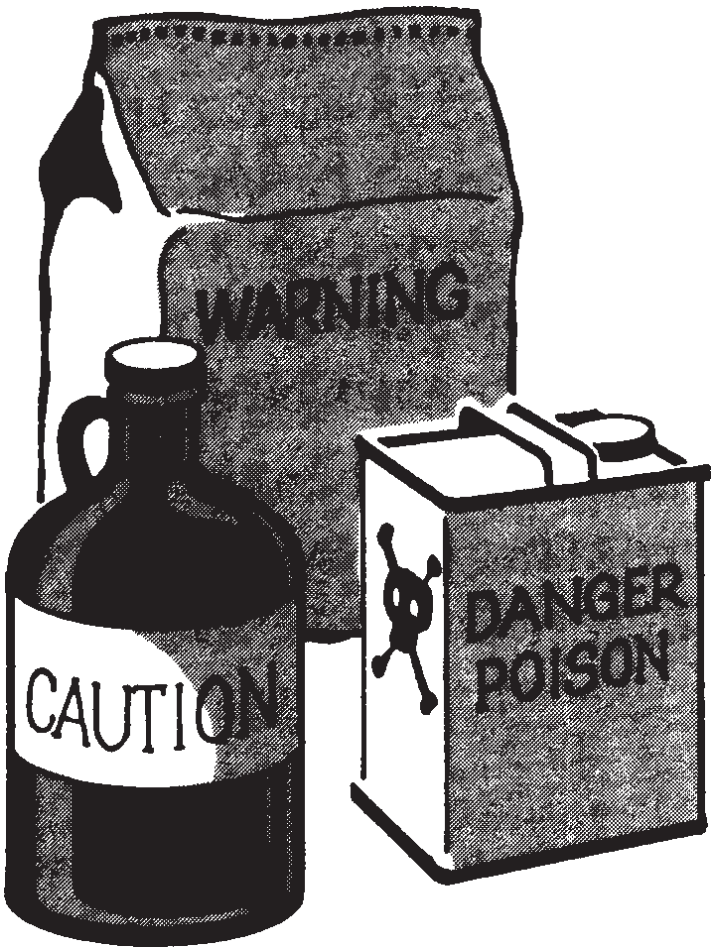
Source: Earth Day 1990, Campus Environmental Audit

Worksheet #1 continued

Questions?

What You Can Do...

2. Naturalize your yard. A perfectly green manicured yard may look good but the products you use on it may be impacting the environment. A natural lawn is just as attractive.



Activity 4. The Great Kentucky Forests

Instruction Sheet

DO YOU KNOW. . .

Z Who owns most of Kentucky's forests?
Z That there is a forest in Kentucky that has been almost untouched for hundreds of years?
Z Which trees are typically harvested from Kentucky's forests?
Z What "clearcutting" is and why the U.S. Forest Service has stopped using it in the Daniel Boone National Forest, located in Eastern Kentucky?

Kentucky Forests Important to the Economy and Environment

Today, many people are concerned, as they should be, about the destruction of the rainforests throughout the world. However, many problems also exist for the forest resources in our own country and state. Kentucky's forests cover nearly half of the state's land area in Kentucky. And while we may think this resource is abundant, our forests are coming under increasing pressure from development, poor harvesting practices, increasing world-wide demand for wood products, and fire.

Kentucky's forests are vital to our economy and the beauty of the state. In order to protect our forestland and ensure it is managed in a manner that will enable future generation's use and enjoyment, we must first become better informed about this important resource.

ZPurpose:

In this activity you will learn about the importance of forestland in Kentucky and in your local area. You will evaluate changes in the growth and removal of the major tree species in your region and review other issues to help you become familiar with forest-related problems and the importance of caring for this valuable resource.

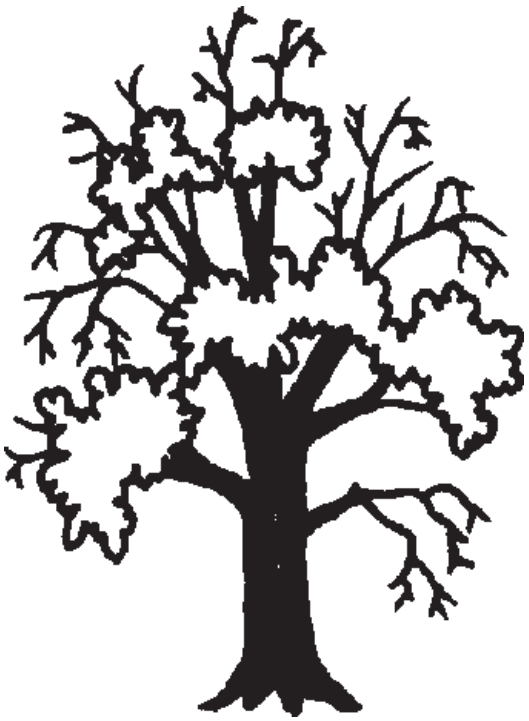
ZProcedure:

Part I - Learning More About Our Forest Resources

1. Obtain Worksheet #1 from your teacher. Review, discuss, and answer questions.

Part II - Identifying Your Local Forest Resources

1. Obtain Worksheet #2 from your teacher. As a class, go to a wooded area or park near your school.
2. Collect leaves from the various tree species in the study area. Identify the trees in the area using Worksheet #2. Compare the species you identify to those listed as the dominant species in Part I of this procedure.
(Note: Worksheet #2 is a leaf identification sheet that contains various tree species common in Kentucky. There are many other types of trees in Kentucky that you might find and want to identify. You could take along a tree identification guide or collect leaves and draw them in the empty boxes on the other side of the leaf identification sheet to identify later.)
3. Determine which trees dominant the area under study and see if they match the types mentioned in Figure 2 on Worksheet #1.
4. Write a summary of your field observations.



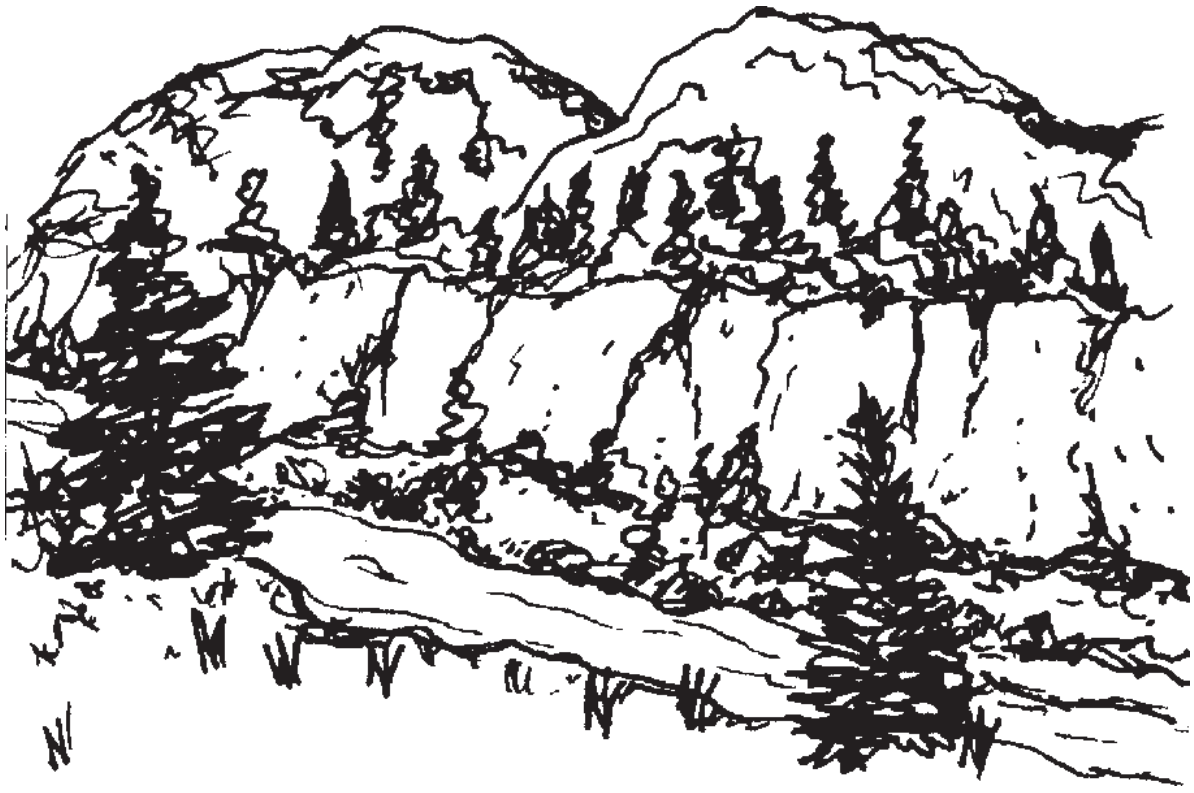
Instructions continued

ZOther Activities:

1. Research the what the different types of forests in the United States and other countries.
2. Invite a state forester to class to discuss Kentucky's forest resources and forestry-related careers.
3. Visit a logging operation, sawmill, papermill, or wood product factory.
4. Research all the ways in which you, your family, and your school depend upon wood and paper products and the types and sources of the wood used. Consider ways to conserve forest resources by wasting less and recycling more.

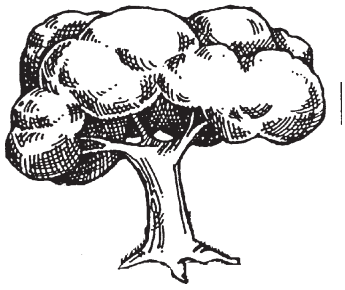
ZReferences/Additional Resources:

Kentucky Division of Forestry, 627 Commanche Trail, Frankfort, KY 40601, 502-564-4496, has field offices located throughout Kentucky that will prepare forest management plans for your family's forest free of charge. The Division can also provide tree seedlings and will assist you with tree planting.



Activity 4. The Great Kentucky Forests

Worksheet #1



Amazing Forest Found in Eastern Kentucky By State Biologist

One day last year Kentucky State Nature Preserves biologist Marc Evans was looking at aerial photographs of the state, hoping to find signs of natural undisturbed areas that might be in need of protection because of rare plant and animal species or other significant features. An area in one photograph caught his attention because it looked like a very large forested area that appeared untouched, but he dismissed the idea because he, like most others, thought nearly all of Kentucky's forests had been logged at one time or another.

Marc believed that the only unlogged old-growth forest left in Kentucky was the 252 acres that make up part of the Lilley Cornett Woods in Letcher County. But something led him to look more closely at the photograph.

After a full investigation Marc found, much to the excitement of scientists and nature lovers throughout the state and nation, that the site was indeed an old-growth forest of incredible beauty, diversity, and size, covering nearly 2,500 acres on the side of Pine Mountain in Harlan County.

The forest was preserved by Mr. and Mrs. Grover Cleveland Blanton who refused to sell the timber. It is one of the state's best kept secrets. Huge trees, that Marc calls cathedral-like, made him "just want to be quiet." The state is hoping to raise enough money to purchase the Blanton Forest, which is among the largest old-growth stands in the Eastern U.S. and preserve it forever as a living Kentucky treasure for all of us to visit and appreciate.

Most of Kentucky's Forests Have Been Cut Several Times

Although the Blanton Forest has not changed much during the last century, the rest of Kentucky's forests have. In the late 1800s, forests were being cut at tremendous rates to clear land for farms and supply a growing market for fuel and wood products.

Today, the indiscriminate clearing of forests is less common. Forestland has increased steadily during the past 35 years. The amount of land growing trees, however, does not provide a complete picture of the health of Kentucky's forests. The diversity of the forest affects its usefulness for recreation, wildlife habitat, watershed protection, and as a source of wood products.

Kentucky's forests are classified as "mixed mesophytic," a type of forest made up of oaks, hickories an other hardwood trees, that cover an estimated 12.7 million acres - 49% of the state's land area. Regional forestland acreage has not changed significantly during the past 24 years, except in the Bluegrass area where acreage increased 38% between 1963 and 1988. Most of this change is attributed to the abandonment of farmland which is now reverting back to forests.

Our forests are made up of the seven major tree groups shown in Figures 1 and 2. Most of Kentucky's forests are composed of hardwoods, although pine and other softwood tree species do occur in the state.

Figure 1

Statewide Changes in Kentucky's Forests

(thousand acres)

Forest Group or Class	1975	1988	Acreage Change	% Change
White/Red Pine	14.3	36.6	+22.3	+156
Loblolly/Shortleaf Pine	679.4	645.5	–33.9	–5
Oak/Pine	800.1	857.9	+57.8	+7
Oak/Hickory	9,169.4	9,515.8	+346.4	+4
Oak/Gum/Cypress	82.0	58.8	–23.2	–28
Elm/Ash/Red Maple	642.7	571.3	–71.4	–11
Northern Hardwoods	514.1	661.4	+147.3	+29
All Groups	**11,902**	**12,347.3 ***	**+445.3**	**+3.7**

*only includes commercial forestland

Note: 1988 data most recent available.

Source: U.S. Forest Service Surveys, 1975 through 1988

Worksheet #1 continued

Figure 2

Kentucky's Forests-Major Groups and Trends

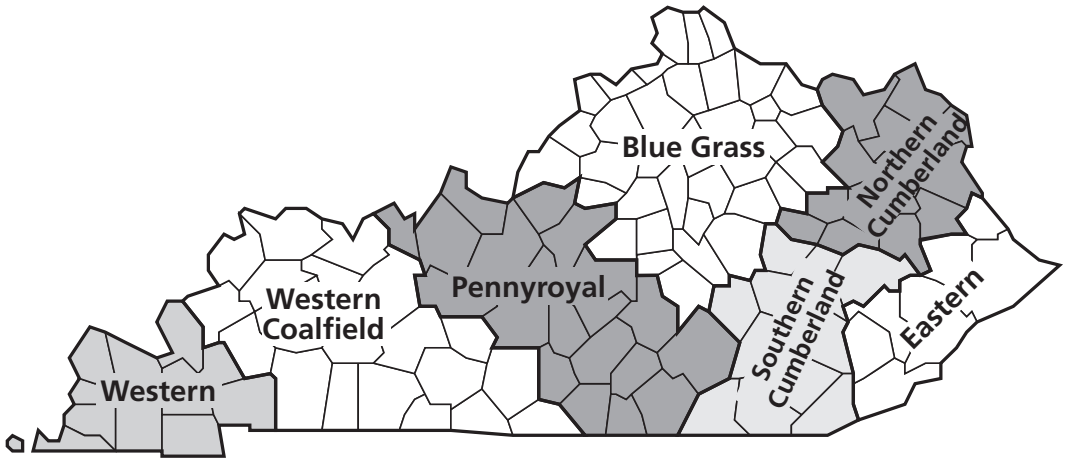
Region/Forest Type	1963	1975	1988
	Forest Acres (thousands)		
West			
Southern Pine	0	7	21
Oak/Pine	6	20	19
Oak/Hickory	298	521	618
Elm/Ash	26	115	88
Northern Hardwood	n/a	20	24
Western Coalfield			
Oak/Pine	16	87	103
Oak/Hickory	724	1438	1361
Elm/Ash	226	137	157
Oak/Gum	69	49	52
Pennyroyal			
Southern Pine	58	149	168
Oak/Pine	48	124	215
Oak/Hickory	879	1704	1640
Elm/Ash	96	75	65
Northern Hardwoods	n/a	75	158
Blue Grass			
Southern Pine	30	88	73
Oak/Pine	22	119	220
Oak/Hickory	283	750	1036
Elm/Ash	178	254	194
Northern Hardwoods	n/a	117	145

Region/Forest Type	1963	1975	1988
	Forest Acres (thousands)		
Southern Cumberland			
Southern Pine	132	261	214
Oak/Pine	275	251	159
Oak/Hickory	870	1561	1629
Elm/Ash	54	11	39
Northern Hardwoods	n/a	58	89
Northern Cumberland			
Southern Pine	99	122	70
Oak/Pine	151	155	100
Oak/Hickory	917	1476	1613
Elm/Ash	22	47	26
Northern Hardwoods	n/a	47	22
East			
Southern Pine	30	51	39
Oak/Pine	38	43	39
Oak/Hickory	775	1716	1615
Maple	104	41	74
Northern Hardwoods	n/a	63	107

n/a - not available

Note: 1988 data most recent available.

Source: U.S. Forest Service Surveys, 1953–1988



Forestland Regions in Kentucky

Worksheet #1 continued

Most Kentucky Forests Privately-Owned

In Kentucky, 84% of forestland is owned by individuals, with the average-size woodlot being 24 acres. These numerous small and fragmented tracts of forestland make the management of this resource difficult. According to a survey conducted in 1978, most Kentuckians do not view their forestland as a financial asset, but rather perceive it as a part of their environment to be used as needed. To many Kentuckians, forests are part of their heritage and to own it is reward enough.

Timber Production Increasing In Kentucky

Logging boomed in Kentucky in the early 1900s. In 1907, timber production in the state peaked at 913 million board feet. At that time, timber-related employment was estimated at 30,000 people. Timber production declined to its lowest level, 207 million board feet, in 1925.

Use of Kentucky's forest for timber products is again on the upswing due to an increase in both U.S. and foreign demand. The state produced 811 million board feet of lumber in 1988, a 30% increase since 1974. The state currently ranks 4th in the nation for hardwood lumber production and supplies, 11% of the U. S. hardwood demand. In 1989, the forest industry employed 24,000 people and produced over $900 million in sales. The total annual impact of this industry in Kentucky, including payroll and timber purchases, amounts to $1.4 billion a year.

Currently, timber is growing at a greater rate than it is being harvested which would indicate that Kentucky's forests are being cut at sustainable levels. More desirable species, however, such as select red oaks, are harvested at an almost even removal/growth rate as can be seen in Figure 3.

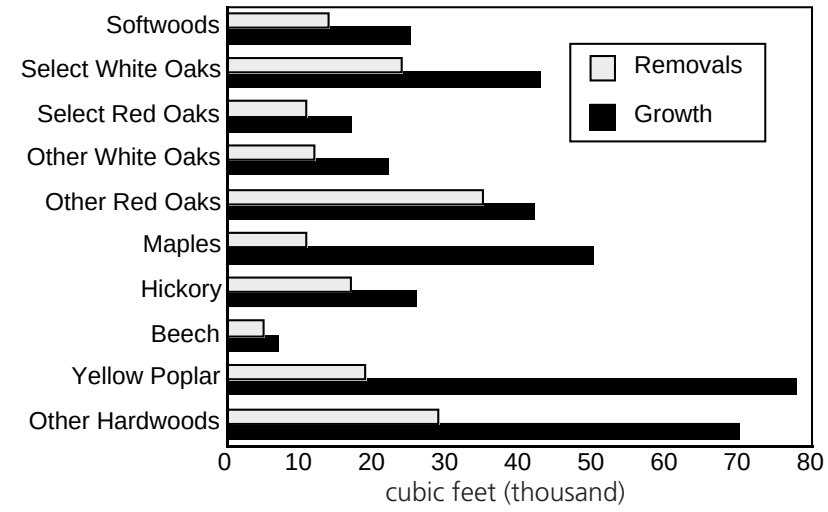
State Promotes Better Forest Management

The primary method of harvesting timber in Kentucky has been highgrading. This method cutting removing quality trees and leaving undesirable or damaged trees, allowing little room for new growth. This type of harvesting has adversely affected the quality of timber available in the state. In 1987, an estimated 4.4 million acres of forestland were in need of improvement, primarily due to highgrading, according to U.S. Forest Service.

Efforts to improve timber quality and to promote proper management and harvesting have been the focus of various state programs. The Kentucky Division of Forestry (KDF) has written 8,420 forest management plans for landowners, covering 663,000 acres of forestland during the past ten years. But these plans address less than 6% of the state's commercial forestland acreage which means we still have a long way to go to manage our forests properly.

Figure 3

Annual Growth and Removal of Trees, Saplings, and Seedlings in Kentucky



Note: A log 18" in diameter and 16' long contains 23.7 cubic feet.

Source: U.S. Forest Service Survey, 1988

Worksheet #1 continued

Clearcutting in the National Forest is Declining

Another method of timber removal is clearcutting. The U.S. Forest Service, the federal agency in charge of protecting and managing our national forests, has historically used clearcutting as its primary harvesting method in Kentucky's only national forest, the Daniel Boone National Forest, located in Eastern Kentucky. This method involves the removal of all trees in average blocks of one to 40 acres.

The U.S. Forest Service has moved away from clearcutting in the Daniel Boone National Forest due to public pressure to reduce the visual impact of clearcutting and to provide a more diverse wildlife habitat.

The public is also pressuring the U.S. Forest Service to reduce timber harvests in national forests due to concerns about the impact timber harvesting has on the environment and wildlife. Continuing public pressure will likely result in less timber production from the Daniel Boone National Forest and other National forests in the U.S. in the future and more reliance on private lands for wood products.

However, some contend that timber production should not be reduced on National forests because it will decrease the number of jobs for those in the logging business. This issue has been intensely debated, especially in the Pacific Northwest where logging is a major industry and forest resources are being cut at alarming rates.

Questions?

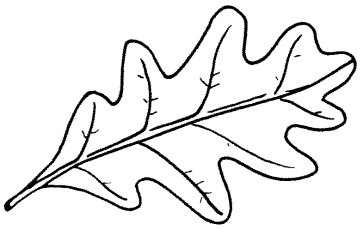
1. What are the major forest groups in your region of the state?
2. Graph the changes that occurred between 1963 and 1988 in the acreage of each major forest type found in your region. Be sure to label each part of the graph.
3. Using Figures 1 and 2, compare the percent change in acreage for each forest type in your region that occurred between 1975 and 1988 to the percent change that occurred statewide.
4. Which tree species are being cut at higher rates based on the information shown in Figure 3? Why do you think this is the case?
5. Who owns most of Kentucky's forests? What kind of forest management problem does this pose?
6. What is the primary method used to harvest Kentucky forests? What problems does this cause?
7. Do you agree with the U.S. Forest Service's actions to eliminate clearcutting? Why?
8. Do you think that areas like the Blanton Forest are worth protecting? Explain your answer.

What You Can Do...

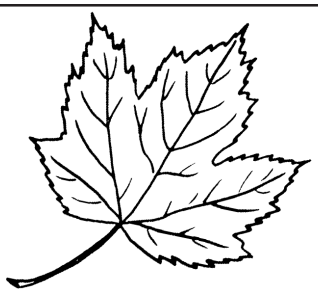
1. You, your class, and your school can help raise money to protect and purchase the Blanton Forest. Contact the Nature Preserves Commission, 406 Broadway, Frankfort, KY 40601, 502-564-2886, to see what you or your school can do to save this valuable resource.
2. Plant a tree every year.
3. If you live in an urban area encourage your community to start an Urban Forestry Program. Contact the Kentucky Division of Forestry to find out more at 627 Commanche Trail, Frankfort, Ky. 40601, 502-564-4496.
4. Go to a wooded area and sit under the biggest tree you can find and enjoy the "Great Kentucky Forests." Consider all the benefits our forests provide and think of other ways that you can help to protect and enhance them.

Worksheet #2

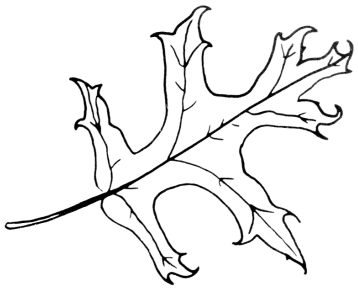
Leaf Identification Sheet



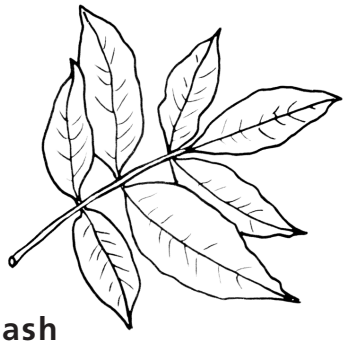
white oak



red maple

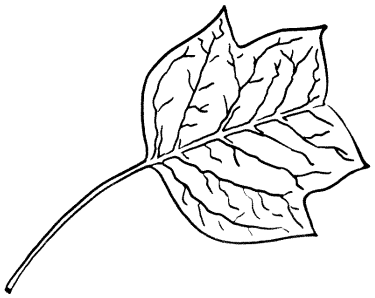


pin oak

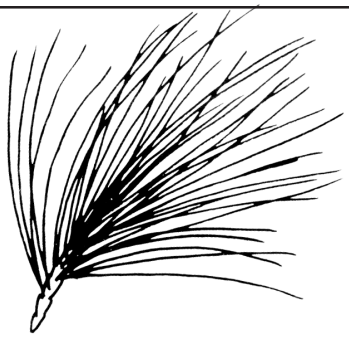


white ash

shagbark hickory



yellow poplar



white pine

walnut

Worksheet #2

Leaf Identification Sheet

Draw and identify other tree leaves in these boxes

Activity 5. Threats to Kentucky's Forests

Instruction Sheet

DO YOU KNOW. . .

Z What the greatest threat to Kentucky's forests is?
Z How driving our cars affects our forests?
Z What a local community can do to promote healthy trees?

Forest Threats are a Problem in Kentucky

Jamie couldn't believe his eyes. Just yesterday he had walked through his family's forest admiring the fall leaf colors and breathing in the clear mountain air. Jamie liked going for walks in the forest, it cleared his head and helped him focus on the important things in his life. But today his world had changed. The forest he so much enjoyed was still smoldering after last night's fire and the brightly colored leaves were now black. "Why?" he asked, "Why?"

During the past 19 years nearly 1.7 million acres of Kentucky's forest have been burned, damaging their ability to produce quality timber, provide habitat to the many animal and plant species, and impacting our use for hiking, swimming, and other recreational activities. But the most alarming fact is that one-third of these fires were purposely set. In 1990, 50% were caused by arson. Kentucky's forests are greatly impacted by fire as well as disease and poor harvesting practices.

Understanding the threats to the state's forests will help you understand what needs to be done to protect these valuable resources now and in the future and help avoid the tragedy that affected Jamie's life and the many other Kentuckians affected by forest fires.

Z Purpose:

In this activity you will investigate the threats to forest resources statewide and in your community. You will learn about how pollution and other factors affect forest resources, what needs to be done to protect them, and how you can be part of the solution.

Z Procedure:

Part I - Forest Resource Threats

1. Obtain Worksheet #1 from your teacher. Review, discuss, and answer questions.

Part II - Making a Difference

1. Create a publicity campaign for your school/community regarding forest fire problems if fire is a threat to your local forest resources. If fire is not a threat in your area, focus your efforts on the need to manage and protect our forests in a sustainable manner. Contact your regional Division of Forestry Office to identify programs that are available to landowners to better manage forestlands and educate others about those programs.

Z Other Activities:

1. Organize a tree planting project for Arbor Day that involves other school/community groups.
2. Organize a school white paper recycling campaign. A ton of recycled paper saves 17 trees, so do your part to conserve our natural resources.

Z References/Additional Resources:

1. Kentucky Division of Forestry, 627 Commanche Trail, Frankfort, KY 4060, has regional field offices located throughout Kentucky that respond to forest fires and will address other forest threats in your community. To find out the closest field office to your community contact the Division at 502-564-4496. The Division will also assist you with tree planting and starting an Urban Forestry Program in your community.

Activity 5. Threats to Kentucky's Forests

Worksheet #1

Many Issues Affect the Health of Our Forestlands

Emotions ran high in Lyon County, Kentucky, as local residents, officials, environmental organizations, and representatives of a proposed "chip mill" clashed over the impacts the mill would have on the region's environment. Opponents of the chip mill contend the mill, as planned, would have chipped thousands of trees, providing relatively few jobs for local residents, and far less income than if the trees were harvested and sold as lumber.

Critics also noted that clearcutting was likely to occur and could have result in widespread destruction of the forestlands in a 75-mile radius around the plant in a few short years. Worse yet, the chips would be shipped to Alabama to be made into paper, creating few new jobs here in Kentucky. Bill Tullar, a resident of the county, said "people come here to hunt, fish, retire, and live. If they (the mill operators) come in and start tearing down all the forests, what will that do to us?"

Mill proponents asserted the operation would be "environmentally friendly" and benefit the economy of the area. Opponents rallied enough support to keep the mill out of their community, but chip mills will likely be proposed in other areas of the state because we have rich forest resources and our forestland is virtually unprotected. Increasing demand for wood products is also expected to increase timber harvesting rates in Kentucky.

This story is an example of the many threats facing our forest resources. However, the most common threat to Kentucky forests today is forest fire. Fire greatly impacts the productivity, diversity, and use of our forests.

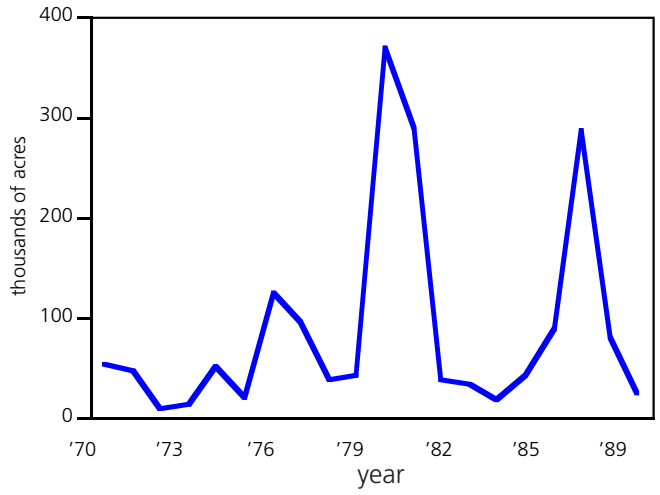
Every year, thousands of acres of forest are scarred and their diversity and value reduced because of forest fires. It is estimated the timber value loss to Kentucky is $86 for each acre of forestland burned. This amount does not include impacts to water, wildlife, or recreation value.

Arsonists Often Responsible for Forest Fires

More than 1.7 million acres of Kentucky forestland have burned during the last 19 years (Figure 1). These fires were accidently caused by individuals burning fields or trash or were purposely set. In 1990, 50% of the forest fires in the state were caused by arson. Most of the forest fires occurring during the last 19 years have been located in the heavily-forested eastern region of the state.

Figure 1

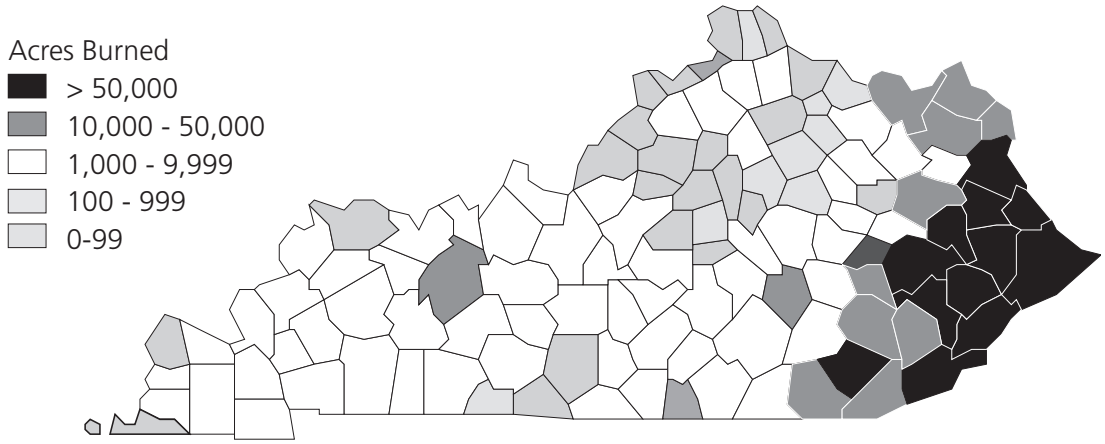
Forestland Burned in Kentucky



Source: Kentucky Division of Forestry, 1991

Worksheet #1 continued

Figure 2
Forested Acres Burned in Kentucky (1970–89)



Source: Kentucky Division of Forestry, 1991

During the past 25 years, the state has issued 13,000 misdemeanor and 245 felony violations to individuals caught or suspected of setting fires. The state also prosecuted 15,000 cases, with a conviction rate of 62%, and recovered $261,000 in fire suppression costs. Both the forest industry and the state offer rewards for information leading to the prosecution of arsonists.

There has also been growing recognition in the courts, particularly in the Central and Western regions of the state, as to the seriousness of forest fire violations. In Central Kentucky, the state has a 100% conviction rate for individuals charged with setting forest fires. Still, much more needs to be done to reduce the number of forest fires in the state.

Insect and Environmental Problems Impact Forestland

Kentucky's forests are also threatened by insects, disease, pollution, and poor harvesting practices. Forest disease is being documented with increased frequency across the state in both urban and rural forested areas.

Oak decline, which has been observed in the Eastern and Southeastern U.S., is a concern in Kentucky since more than 50% of the growing stock are oak species. The cause of oak decline is not known.

Gypsy moth movement into Kentucky from the Northeastern U.S. is a potential threat to our forests. These insects have defoliated entire forests of the east. Some gypsy moths have been found in the Commonwealth in widely scattered locations.

Ozone pollution, or smog, is now recognized as an increasing threat to forests. A study commissioned by the state in 1988, revealed that ozone or smog, an air pollutant formed when automobile exhaust, and vapors from gasoline, solvents, paints, and other chemicals react in the presence of sunlight, can negatively affect tree growth. While the study concluded some forested areas are exposed to ozone levels that may decrease tree vigor and lead to increased dieback and decline, more research is needed to fully determine its impact.

Another threat to forests is acid rain. Acid rain is formed by pollutants created when fossil fuels such as coal and petroleum are burned for energy. Acid rain damage to spruce forests, particularly those at or above altitudes of 1,000 meters, has been recorded in the North Carolina Appalachian Mountains as well as in the Northeastern U.S. and Canada. A 1988 acid rain study concluded Kentucky forests are not immediately at risk from acid rain damage due to species composition, altitude, and limestone buffering soils.

Worksheet #1 continued

Forestland Erosion Improving, But More Efforts Needed

Soil runoff from forestland is also a serious problem because its pollutes our streams, rivers, and lakes and our ability to use those waterways for swimming, fishing or as a drinking water source. Runoff from forests is caused by improper logging and road building. The control of erosion from forestlands has improved somewhat over the years. The average amount of soil eroded from rural forestland declined from three tons an acre in 1982, to 1.48 tons an acre in 1987. But 487,000 acres of forest still need to be reinforced with trees to control erosion.

Runoff pollution from timber harvesting and forestry activities such as logging and road construction is controlled through voluntary measures. The Kentucky Division of Forestry promotes tree planting, installation of water bars (soil ridges) to divert runoff from logging roads, seeding logging roads, and other methods to reduce forestland erosion. The Division also encourages loggers to control erosion during timber harvesting to minimize impacts to streams.

While steady progress has been made in controlling runoff pollution from forestlands, soil erosion from forestry activities is still polluting streams in ten of the state's 13 major river basins. Kentucky received $1.5 million in federal funds in 1991 through the Forest Stewardship Program to help landowners address erosion and protect streamside corridors.

Tree Planting Becomes Popular in Kentucky

The Kentucky Division of Forestry sells about 9 million seedlings each year and an estimated 12,857 acres of land are planted with trees annually in Kentucky. The state sells tree seedlings through its two nurseries to private citizens and groups interested in helping to improve and restore Kentucky's forests.

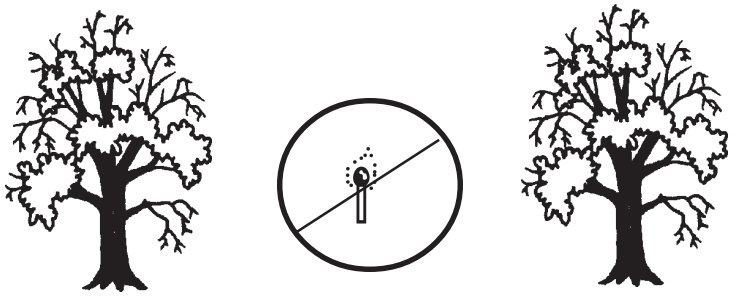
Awareness of the importance of trees, particularly in urban areas in reducing noise and air pollution, has led to increased tree planting in communities across Kentucky. A popular local project involves the formation of tree commissions to survey the health of trees and determine planting needs. In 1988, only one city in Kentucky had a tree commission. By 1990, local tree commissions were active in 25 communities throughout the state.

Questions?

1. What is the greatest forest threat in Kentucky? Why do you think this is the case? Explain your answer. Suggest some ways to address this issue.
2. What are some other forest threats in Kentucky? Why are these threats?
3. How many acres of forest burned in your county between 1970 and 1989? Compare the amount burned in your county to the county that had the most and the least acreage burned?
4. How many millions of dollars have fires cost Kentucky in lost timber value?
4. Are there any benefits of creating a tree commission in your community? Name some of the benefits and discuss whether you think such a commission would be good for your community.

What You Can Do. . .

1. Organize a tree planting campaign for your school or community.
2. The Kentucky Division of Forestry can help you set up an urban forestry program in your community and advise you about managing woodlands properly for wildlife habitat, timber production, recreation, and other uses through their Forest Stewardship Program. Funds are even available for some activities. Contact the Division at 627 Commanche Trail, Frankfort, KY 40601, 502-564-4496.



Activity 6. Kentucky's Endangered Wetlands

Instruction Sheet

DO YOU KNOW. . .

- Why wetlands are an important part of our natural environment?
- What has caused the destruction of many wetlands in Kentucky and the rest of our nation?
- Why wetlands are critical to the survival of many threatened and endangered species?

Wetlands Valuable, But Many Lost or Threatened

The scene hardly resembled a summer-school classroom. The students were dirty and sweaty, and they were working as music blared from a radio atop a bale of straw. But several of the nearly 30 students digging a ditch, checking elevations, or finishing a small dirt dam called it one of the most enriching educational experiences of their lives. As part of their biology class in the Governor's Scholars program, they were converting a small field to a wetland. "I've learned an incredible amount about wetland ecology," said Brian Berger, 17, of St. Xavier High School in Louisville. Berger also acknowledged that the experience may have diverted him from his planned career in medicine to one in some area of ecology. (Excerpted with permission from the Courier-Journal, 8/3/92-*Young Scholars Gladly Leave Old School Strictures Behind*)

As these students learned, wetlands are some of our most important natural resources providing flood control, habitat, and many other valuable benefits. Unfortunately, Kentucky has lost nearly 80% of its wetland resources. Most were cleared and drained for agriculture and other uses. However, there are still some outstanding wetlands left, primarily in Western Kentucky, that can be protected.

Purpose:

In this activity you will review the importance of the state's wetlands and learn more about the threats posed to these valuable resources. You will also identify some of the wetlands that are threatened in Kentucky and research what needs to be done to protect these areas.

Procedure:

Part I - Learning More About Wetlands

1. Obtain Worksheet #1 from your teacher. Review, discuss, and answer questions.

Part II - Protecting Wetlands in Kentucky

1. Divide into teams of two. Using Figure 2 on Worksheet #1, select one of the critical wetlands identified in the state.
2. Research the status of the wetland by contacting the Kentucky State Nature Preserves Commission, 406 Broadway, Frankfort, KY 40601, 502-564-2886. Ask for information regarding the size, rare/endangered species, threats, and protection needs related to the wetland under study.
3. Research how wetlands function and the benefits they provide. (A good article was printed in the Courier-Journal on January 11, 1993).
4. Prepare a report of your team's findings and present a summary to your class. Include in your report whether Kentucky should protect the wetland you studied and why.

Part III - Getting Out Into the Field

1. Visit a wetland, State Nature Preserve, or State Wildlife Management.
2. After your visit, discuss how the biological diversity of the area you toured differs from other areas such as an agricultural field. Discuss the importance of protecting these areas.

Instructions continued

Other Activities:

1. Research the use of constructed or artificial wetlands to treat sewage and acidic drainage from abandoned coal mines.
2. Invite a biologist from a nearby university, a representative from the Kentucky Department of Fish and Wildlife, or the Kentucky State Nature Preserves Commission to discuss wetland issues.
3. Research the current issues affecting wetlands and debate the pros and cons of protecting wetlands in Kentucky.

References/Additional Resources:

1. The Kentucky Department of Fish and Wildlife Resources manages 25 Wildlife Management Areas. Contact the Department at the Arnold L. Mitchell Building, #1 Game Farm Rd., Frankfort, KY 40601, 502-564-4336, for more information about these areas.
2. The Kentucky State Nature Preserves Commission, 406 Broadway, Frankfort, KY 40601, 502-564-2886, can provide you with more information about wetlands and the 30 State Nature Preserves managed by them.

Activity 6. Kentucky's Endangered Wetlands

Worksheet #1

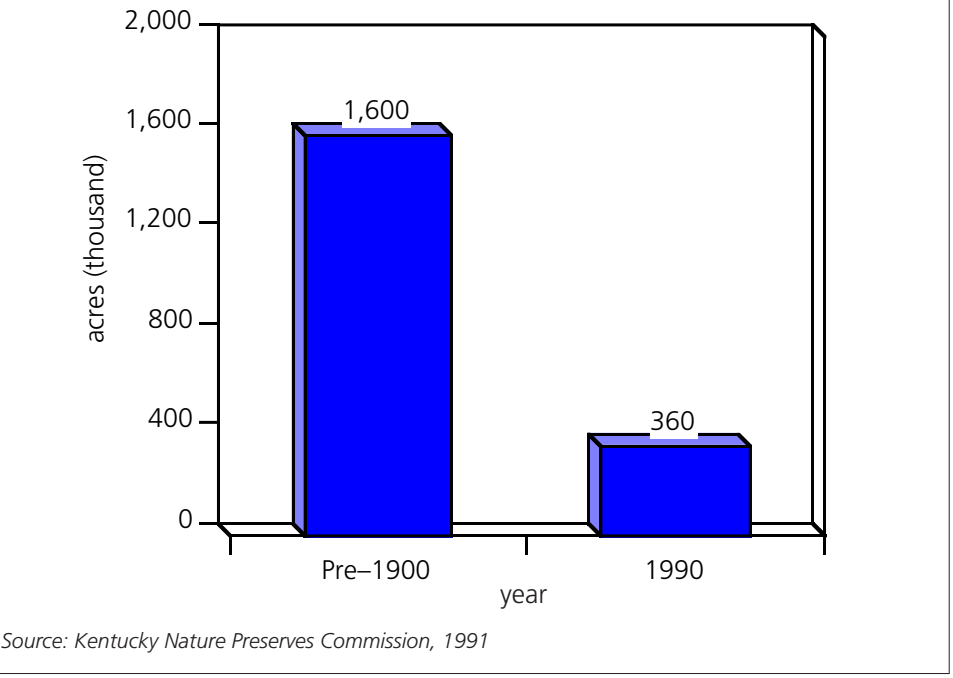
Wetlands Offer Many Benefits

The clanging of aluminum canoes echoed across the swamp. Wildlife of many varieties ducked for cover in Murphy's Pond. The visitors, led by Dr. Duke Wilder, a professor of biology at Murray State University, were canoeing the pond on a tour of what is now one of the few remaining cypress swamps left in Kentucky.

Murphy's Pond is an outstanding example of a "wetland." The pond teems with creatures such as the highly poisonous water moccasin, affectionately known as the "cottonmouth"- due to the white mouth the snake shows off to those who are lucky enough to see it...*from a distance*. Although Murphy's pond will soon be protected as a State Nature Preserve, most of the few remaining wetlands in Kentucky are endangered, but they are valuable resources that most people are just learning to appreciate.

The inexperienced canoeists tried their best to keep from falling into the swampy tangle of bushes, cypress trees, snakes, and other wildlife most people never get to see. They paddled through the dense vegetation hoping to catch a glimpse of something unusual. The pond seemed to be a world of its own, nearly untouched by human impacts and alive with birds, turtles, rare plants, and beautiful flowers. A cottonmouth darted across the water in front of one of the canoes...the visitors were thrilled by the sight...but even more thrilled to be in the boats. That was of course, until their guide told them that some of the pond's slithery snakes liked to curl around branches and bushes and *DROP INTO BOATS*!!!

Figure 1



Source: Kentucky Nature Preserves Commission, 1991

Worksheet #1 continued

Figure 2
Priority Wetlands in Kentucky Providing Habitat

Wetland	County	Destruction Threat*
Blood River Bottoms and vicinity	Calloway	M/L
Shawnee Creek System	Ballard	M
Laurel County Swamp	Laurel	M/L
Salt River (Lower) Rolling Fork	Nelson, Hardin, Bullitt	L
Transient Lakes, etc.	Warren	L
Rockcastle County Swamp	Rockcastle	M/L
Washington County Swamp	Washington	M/L
Wayne County Swamp	Wayne	M/L
Humphrey Creek System	Ballard	M
Metropolis Lake Area	McCracken	L
Deer Creek System	Webster	M/L
Cypress Creek System (Tennessee River)	Marshall	M/L
Christian County Swamp	Christian	M/L
Logan County Pond	Logan	L
Hardin County Sloughs	Hardin	L
Hardin County Pond	Hardin	L
Simpson County Swamp	Simpson	L
Johnathan Creek Bottoms, etc.	Calloway, Marshall	L
Running Slough, etc.	Fulton	H
Pond River System	Webster, McLean, Muhlenberg, Hopkins	H
Cypress Creek System (Green River)	Muhlenberg, McLean	H
Obion Creek System	Fulton, Hickman, Carlisle, Graves	H
Bayou de Chien System	Fulton, Hickman	H/M
Clarks River System	Marshall, Graves, McCracken	H/M
Tradewater River System	Hopkins, Caldwell, Webster, Crittenden, Union	H/M
Mayfield Creek System	Carlisle, Ballard	H/M
Terrapin Creek System	Graves	H/M
Muddy Creek/Little Muddy Creek	Ohio	H/M
Fish Lake/Bach Slough/Laketon Area	Carlisle	M
Richland Slough Area	Henderson	H/M
Panther Creek System	Calloway	H/M
Highland Creek System	Union, Henderson	M
Mud River/Roundabout Swamp System	Butler, Logan, Muhlenberg	M/L
Pond Creek System	Henderson	H
Green River (mainstream)	Edmonson, Barren, Hart, Warren, Metcalfe, Grayson	M
Rough River	Ohio, Grayson	M
Henderson County Wetlands	Henderson	M

**L = Low, M = Moderate, H = High*

Note: Generic wetland names. Priority based on threatened and endangered species habitat.

Source: Kentucky Nature Preserves Commission, 1991

Worksheet #1 continued

80% of Kentucky's Wetlands Destroyed

"Wetland" is a collective term used to describe a variety of ecosystems which include swamps, marshes, and other transitional zones that exist between open water and dry land. Wetlands occur where water is found at, or near, the ground surface, or in places where the ground is covered by shallow water ranging from a few inches to several feet deep.

It is important to note that wetlands are not necessarily wet all year. Many, such as bottomland hardwood forests, are often dry during certain periods of the year. Therefore, the casual observer may not always be able to recognize or correctly identify wetlands.

In their natural condition, wetlands offer many benefits. They provide habitat to a multitude of fish and wildlife species, many of which are endangered or threatened. Wetlands provide erosion and flood control and filter pollutants before they enter streams and groundwater. Wetlands are believed to contribute to climatic influences as well.

In the past, wetlands were often regarded as wastelands - sources of mosquitoes, flies, and unpleasant odors. Wetlands were drained and filled for agriculture and other development purposes because people did not recognize their importance.

Originally Kentucky had an estimated 1.6 million acres of wetlands but by 1993, only 360,000 acres remain, representing a total loss of about 80% (Figure 1). The current rate of loss in the state is estimated to be 3,600 acres per year. The decrease in wetlands is thought to be impacting duck populations greatly in Kentucky. Ducks and other types of waterfowl depend on wetlands for habitat and food. Duck populations in Kentucky have declined by 50% since 1959.

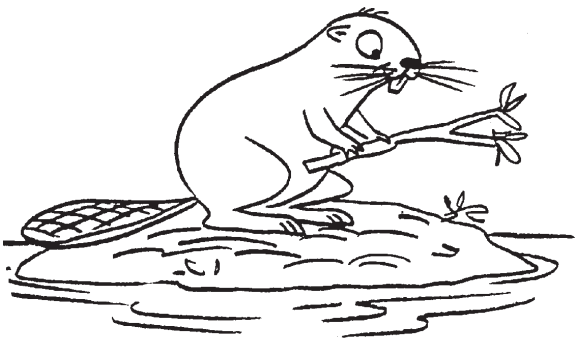
Increased Understanding of Importance of Wetlands Leads to Protection Measures

An increased understanding of ecological importance of wetlands has changed the attitude of many Kentuckians. People now better understand the valuable natural resources and benefits that wetlands provide. For example, approximately 45% of the animals and 26% of the plants that are endangered or threatened depend on wetlands during some portion of their life cycle.

But federal and state laws designed to control activities that destroy wetlands have caused intense controversy between regulators, property owners, scientists, developers, environmentalists, sports groups, and others who have differing opinions about how wetlands should be managed and preserved.

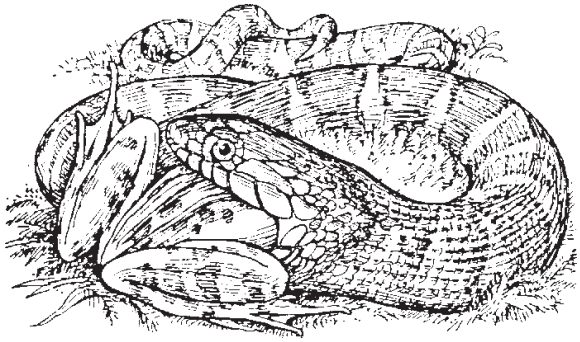
The main arguments center around how to define a wetland, whether wetlands that are converted to other uses should be replaced by creating other wetlands, and whether landowners should be compensated financially if they cannot drain or fill a wetland on their property. The state recently mapped wetlands throughout Kentucky to help control activities that may damage them.

Protecting Kentucky's wetlands will be a complex task requiring the cooperation of all Kentuckians if we are to save the few remaining wetlands left in the state.



Worksheet #1 continued

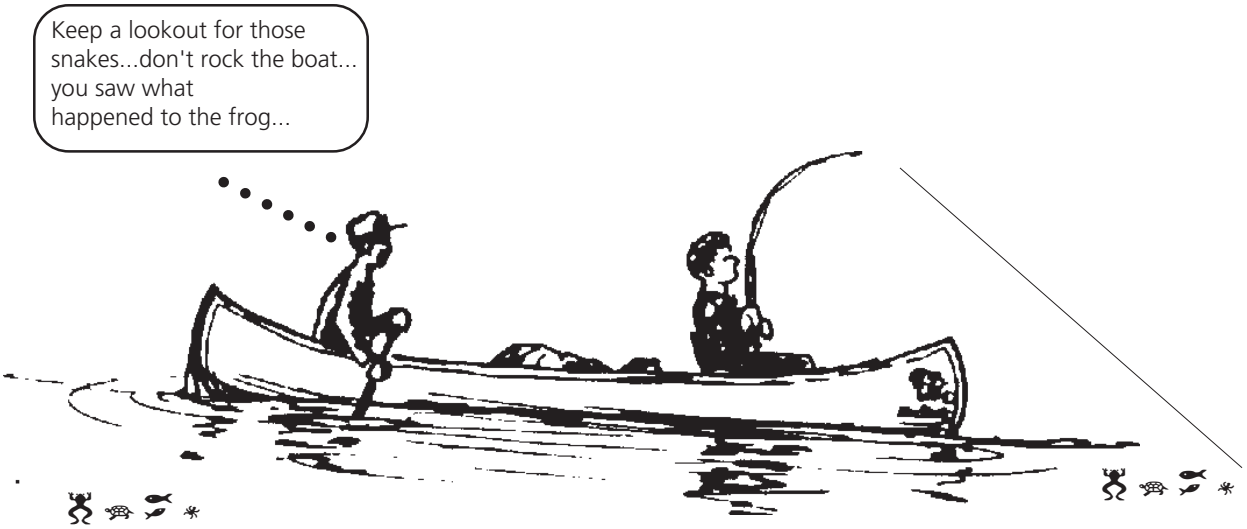
Questions?



1. Do you think Kentucky's wetlands are important? Explain your answer.
2. Based on the current rate of wetland loss how many acres of wetlands will there be in the year 2000?
3. What are some of the challenges to protecting wetlands in Kentucky?
4. Some believe that a landowner with a wetland on her/his property should be paid *not* to destroy it, if the government passes laws to protect wetlands that restrict the owners ability to alter or destroy the wetland. Others argue that this would be too expensive to taxpayers and the public good served by protecting wetlands outweighs individuals rights in some cases. Prepare a one page essay on how you feel about this issue.
5. Have you ever been to a wetland? If so, describe it. If not, describe what you think it would look like.

What You Can Do...

1. Report dredging or filling activities that impact wetlands to the Kentucky Division of Water, 14 Reilly Rd., Frankfort, KY 40601, 502-564-3410. A permit is required to conduct this type of activity.
2. Find out more about the wetlands where you live and what needs to be done to protect them.



Activity 7. The Land That Breathes

Instruction Sheet

DO YOU KNOW. . .

Z How many caves have been discovered in your county?
Z Why Native Americans called Kentucky "The Land That Breathes?"
Z Why caves need to be protected?

Caves are Valuable Part of State Heritage

If you had told John MacGregor when he was in high school that 15 years later he would be roaming around caves and catching bats he would of told you that you were crazy. But John, a wildlife biologist with the U.S. Forest Service at the Daniel Boone National Forest, will tell you it is the best job in the world. John along with volunteer cavers are doing their best to protect the caves of Kentucky and the animals that inhabit them.

Although our caves are among Kentucky's most unique natural resources, they are subject to many threats from environmental pollution and other human activities. The public is beginning to understand the value of caves and awareness is growing about their vulnerability.

Although there are increasing efforts to protect caves and minimize the human impact to the wildlife which depend upon them, more needs to be done if we are to preserve this important part of Kentucky's heritage.

Z Purpose:

In this activity you will find out how many caves have been discovered in Kentucky and in your county. It will also help you understand the problems facing these valuable resources, the species which depend upon them, and what you can do to help preserve them.

Z Procedure:

Part I - Understanding Our Cave Resources

1. Obtain Worksheet #1 from your teacher. Review, discuss, and answer questions.

Part II - Investigating Cave Habitat

1. Select an endangered species dependent on caves for its habitat. Prepare a research report about the species, its importance, and what efforts are being made, or need to be made, to protect its habitat.
2. Summarize your findings and present them to the class.
3. As a class discuss the importance of caves and other natural areas in Kentucky.

Part III - Exploring A Cave

1. Visit a cave near your area where tours are conducted. Explore its environment, living species, and what historic role it plays in your community and the state.

Z Other Activities:

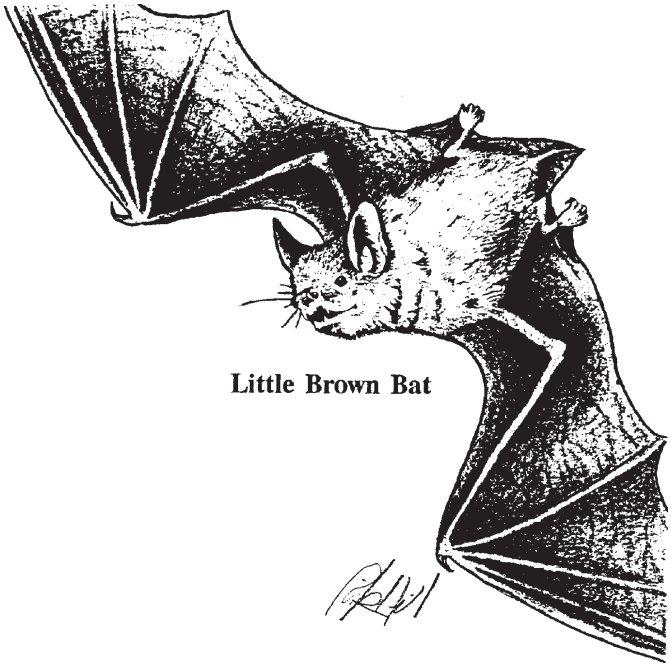
1. Research the term "biodiversity" and its importance to Kentucky, the nation, and our planet.
2. Conduct a research project on current state and federal laws that were enacted to protect caves and how effective these laws have been.
3. Create a video documentary on natural areas in your county and their importance in your community.

Z References/Additional Resources:

1. The American Cave and Conservation Association, located in Kentucky, can provide information about caves in the state. Contact the Association at 31 East Main St., Horse Cave, KY 42749, 502-786-1466.

Activity 7. The Land That Breathes

Worksheet #1


Little Brown Bat

Caves Have Historical, Financial Benefits, and Provide Critical Habitat

Native Americans who once roamed Kentucky called it the "land that breathes." This was because of the widespread presence of caves which is one of the state's most unique natural features.

If you stand outside the entrance of a cave on a cool morning you will see warm air from deep inside rising and condensing when it meets the colder outside air, much like your breath does on a cold day. The Indian's description, "the land that breathes," was a good one. Approximately 50% of the state is underlain by cave-forming limestone. Groundwater dissolves rock surfaces forming large sinkholes, channels, and caves. These areas are commonly known as "karst" regions. More than 4,000 caves have been discovered in 87 Kentucky counties (Figure 1).

Caves have many important historic, economic, cultural, recreational, and ecological values. Many communities originally developed around caves and springs because they offered water supplies. Mammoth Cave, the largest known cave system in the world, attracts 1.5 million visitors a year to Kentucky. These visitors spend $250 million annually while enjoying Mammoth Cave National Park located in Edmonson, Hart, and Barren counties. Caves also provide habitat to several threatened and endangered species of bats and many other species.

Pollution Problems Impact State's Best Cave Systems

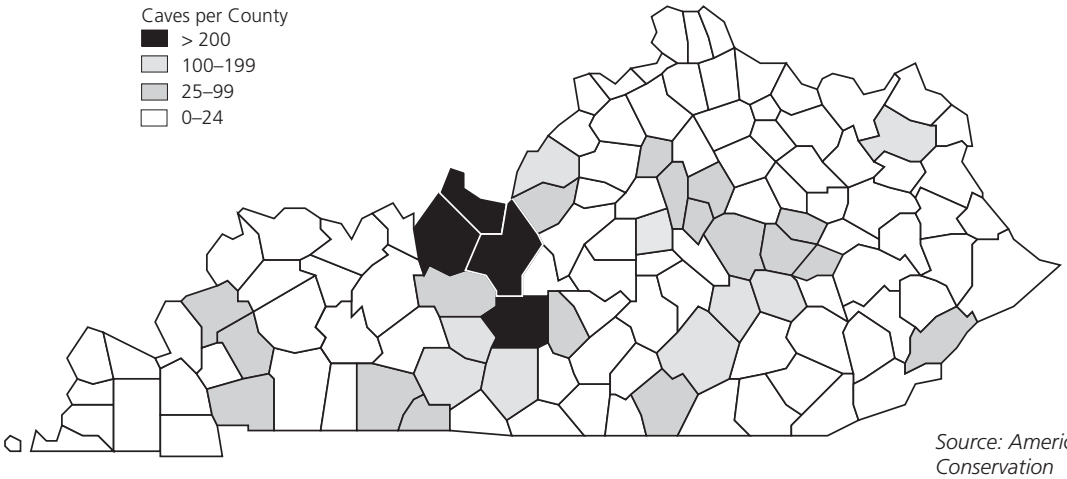
Caves are extremely vulnerable to nearly every type of pollution. Pollutants can enter caves from groundwater and surface water. Vandalism and open dumping are also a problem.

Sewage contamination has threatened Mammoth Cave National Park to the extent it was nearly closed for public health reasons. Fortunately, construction has begun on a regional sewage treatment system to help solve the problem at Mammoth Cave. The National Park Service initiated a three-year "Mammoth Cave Water Quality Program" in 1990 to further assess trends and pollution problems in the Green River Basin that are potentially impacting the park.

Water pollution caused by improper sewage treatment has also significantly impacted Hidden Rivers Cave in the City of Horse Cave in Hart County. The cave was once a popular tourist attraction, until raw sewage contamination began pouring into the cave making it unsafe for visitors. But the community has built a new sewage treatment plant and conditions have improved to the point that the rare blind cavefish once common in the area, which disappeared in the 1950's due to the pollution problems, is now returning to the cave. Experts think ancestors of the cavefish probably hid out in an unpolluted, underground area far upstream of the cave. Local residents happily report cavefish have been recently seen within a mile of the cave entrance.

Worksheet #1 continued

Figure 1
Caves of Kentucky



Source: American Cave Conservation Association, 1991

Endangered Species Depend Upon Caves

Caves in Kentucky provide habitat to more than 200 living species. These cave-dwelling species are at risk from competition with non-native species, pollution, and development pressures. The native gray bat population has decreased from 515,000 in 1979, to only 200,000 in 1990. The Indiana bat, a federally-protected endangered species found in Kentucky, is declining 7% each year due, in large part, to the loss and degradation of cave habitats.

In 1988, the federal Cave Resources Act was adopted by Congress to ensure caves on federal lands with significant qualities such as archaeological artifacts, endangered species, and other features of public interest were properly managed to prevent degradation.

Kentucky also passed a law making it illegal to harm or disturb naturally occurring animals and other organisms that live in caves. The law also restricts dumping waste and other activities that deface or degrade caves. State permits are required when any archaeological or historical feature is excavated from a cave. The Kentucky Department of Fish and Wildlife Resources helps to protect caves and their inhabitants by placing gates at some cave entrances to minimize disturbances to the many sensitive species inhabiting them.

But protecting caves and the animals that inhabit them has been difficult mainly due to our ignorance and fear of many of these creatures. In Breckinridge County a few years ago, someone scraped 288 bats off a cave ceiling and stomped them to death.

Worksheet #1 continued

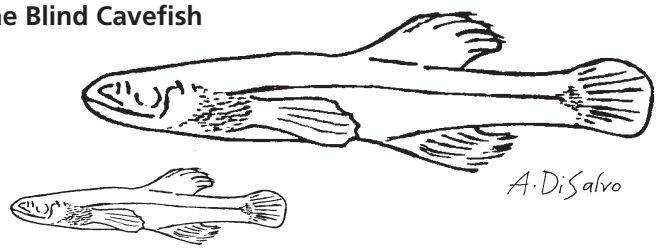
Questions?

1. Approximately how many caves are located in your county?
2. Which general area of the state has the greatest concentration of caves?
3. If Mammoth Cave had to be closed due to environmental pollution what would likely be the reason? How much tourism-related money would the communities in which it is located lose?
4. Have you ever been in a cave? If so, describe the experience and what you saw. If not, describe what you think it would be like.
5. Do you think endangered species who depend on caves should be protected? Explain your answer.

What You Can Do...

1. Avoid entering caves that are not already being used for tours because your presence may disturb species that are very sensitive and force them to flee out of fear.
2. Report anyone who defaces caves or dumps waste in them to your local law enforcement officials or the American Cave Conservation Association, 502-786-1466.

The Blind Cavefish



The blind cavefish is about two inches long and has adapted to life in the darkness. Their eyes are covered with skin and their bodies have small sensors that enable them to detect slight movements in water which help them navigate and catch food. Cavefish had not been seen for 30-40 years in Hidden Cave due to pollution. However, last New Year's Eve cave explorers saw some cavefish swimming in the river flowing through the cave indicating efforts to clean up environmental contamination in our waterways are achieving results.

Activity 8. Kentucky's WILD SPECIES

Instruction Sheet

DO YOU KNOW. . .

- How many different species are known to exist in Kentucky?
- Whether there is an endangered species in your county?
- What the single most important factor is in protecting threatened and endangered species in Kentucky?

Wildlife and Other Species Need Our Help

"Biodiversity" is a term used to refer to the complex web of living things and ecosystems that collectively make up the natural world. In Kentucky, and all over the planet, living species and their habitat are being lost or diminished. Destruction and degradation of habitat ultimately causes many species to become endangered with extinction. The loss of the biodiversity is considered one of the greatest ecological crises facing the world today. When species and ecosystems become less diverse, the richness and resiliency of nature declines.

Whenever an area of land is paved for a shopping center, divided up into subdivisions, or plowed to grow a crop - small animals, plants, and other species lose their homes, and frequently their source of food and water. These disturbances are especially difficult for sensitive species who cannot easily adapt to changing conditions.

As these species disappear, so do the larger animals that previously depended upon the smaller animals in the food chain. Animals that cannot tolerate human intervention may also disappear without any direct relationship to the food chain. You can often observe this phenomenon near your home and school.

Kentucky's animal, plant, and other species face tremendous challenges due to the changes we have made to our landscape and water resources. Protecting our wild species and natural heritage is a effort that requires the help of everyone.

Purpose:

In this activity, you will analyze the trends in population of Kentucky's plant, animal, and other species and the problems facing them today. You will also investigate the state's threatened and endangered species and research some in detail to determine what needs to be done to protect them from further decline and extinction.

Procedure

Part I - Learning More About Wild Species in Kentucky

1. Obtain Worksheet #1 from your teacher. Review, discuss, and answer questions.

Part II - Exploring Endangered Species in Kentucky

1. Obtain Worksheet #2 from your teacher. Choose one of the threatened or endangered species in Kentucky to research in detail.
2. Research the habitat, lifecycle needs, and the status of the species you have chosen. Prepare a one-page report on the species you selected.
3. Prepare a display on a posterboard including a sketch of your threatened species and other appropriate information. Include what needs to be done to protect the species you researched. Display the posters in class and throughout the school to educate others.
4. Follow-up your research as a class with letters to the agencies mentioned in Worksheet #1 that have responsibility to protect threatened and endangered species. Ask what you can do to help protect rare species. Discuss the responses in class.

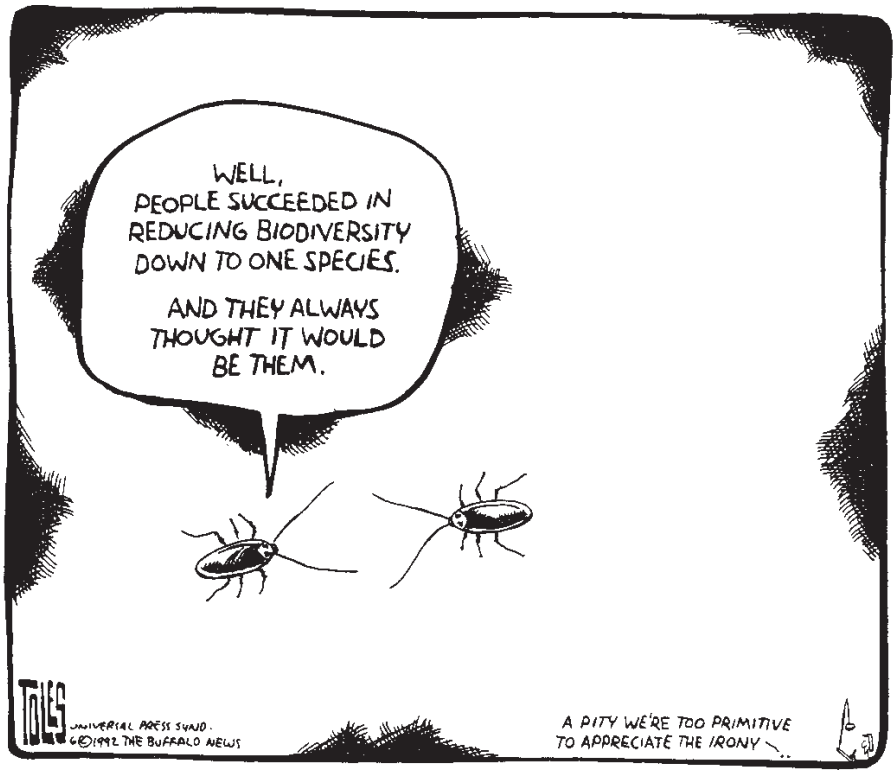
Other Activities:

1. Conduct a research project on the federal National Endangered Species Act.
2. Research the current controversy regarding logging in old-growth National Forests of the Pacific Northwest and the protection of the rare spotted owl that inhabits the forests. Debate the issue in class, and consider how it could have been avoided, and ways to we can better protect endangered species and their habitats.

Instructions continued

References/Additional Resources

1. The Kentucky Department of Fish and Wildlife Resources is responsible for protecting threatened and endangered wildlife in Kentucky. Contact them at the Arnold L. Mitchell Building, #1 Game Farm Rd., Frankfort, KY 40601, 502-564-4336.
2. The Kentucky State Nature Preserves Commission, 406 Broadway, Frankfort, KY 40601, 502-564-2886, is responsible for protecting rare plants in Kentucky and can provide information about these and other species
3. Teachers: The Kentucky Department for Fish and Wildlife Resources offers many learning activities through "Project Wild" and other programs. Contact the Department at the address listed above.



Activity 9. Birds of Kentucky

Instruction Sheet

DO YOU KNOW. . .

- Why 52% of the 116 nesting birds species surveyed in Kentucky have declined in number?
- How you can help protect birds in your community?

Birds Declining in Number, Protection Efforts Increasing

Many of Kentucky's bird species are decreasing in number, especially those that cannot readily adapt to changes in habitat or are sensitive to pollution. During the last decade, 52% of the 116 nesting bird species surveyed in Kentucky were discovered to be declining. However, efforts to protect habitat and reduce the impact of environmental pollutants, combined with bird and habitat restoration programs, are helping to improve populations of some species.

Purpose:

In this activity you will study population trends of selected bird species in Kentucky and distinguish the habitat requirements of several birds. You will also investigate ways that you can help to create and protect habitat at your school, home, and community.

Procedure:

Part I - Learning More About Birds of Kentucky

1. Obtain Worksheets #1 and #2 from your teacher. Review, discuss, and answer questions.

Part II - Why are Some Birds Declining?

1. Choose 5 bird species of interest to you from Worksheet # 2.
2. Research each bird species you selected and prepare a report which suggests the reasons for changes in population based on your knowledge of the bird's habitat and changes in land use in your community (especially those that might effect habitat). The report should also indicate whether you think each of the species you chose will likely increase in number, decrease, or remain about the same in the future, particularly in your region of the state. Support your conclusions with information available.

Part III - Investigating the Habitat of Birds in Your Community

1. Obtain a copy of the Backyard Bird Survey Sheet from your teacher. Identify how many different species of birds visit your back yard or other area near your school in one day. Try to identify as many species as you can. If you can't identify a species, describe it on the survey sheet and refer to a bird guidebook from the library to see if you can find a picture of the bird. Be sure to indicate where you saw the bird (city, country, or suburb).
2. Report your findings to the class and compare them to those of other students.
3. As a class, discuss the differences in bird species and how habitat influences their population.

Part IV- Making a Difference

1. Establish habitat for the birds in your region that are declining in number. This activity could involve other classes such as industrial arts, etc. who could help to build and maintain birdhouses and feeders. Be sure to research habitat and other needs of the species thoroughly before starting. The Kentucky Department of Fish and Wildlife Resources provides information and possible funding for habitat projects at schools and homes. Contact the office at 502-564-4336 for more information about the Habitat Improvement Program and the Wild School Sites Program.

References/Additional Resources:

1. The Kentucky Department of Fish and Wildlife Resources can provide more information about birds. Contact the Department at the Arnold L. Mitchell Building, #1 Game Farm Rd., Frankfort, KY 40601, 502-564-4336
2. The Kentucky State Nature Preserves Commission, 406 Broadway, Frankfort, KY 40601, 502-564-2886, can also provide you with more information about birds and other species of rare animals and plants in Kentucky.
3. Zoos, such as the Louisville Zoo and the Cincinnati Zoo are good sources of information about birds and other wildlife.

Activity 9. Birds of Kentucky

Worksheet #1

Students Take Action to Help Birds

Students in Garrard County, Kentucky, were concerned about the decline in the number of eastern bluebirds in the last few decades. Eastern bluebirds are beautiful creatures with iridescent blue feathers that seem to glitter in the sunshine. Bluebirds have declined in number largely as a result of the destruction of their habitat.

This year the Garrard High School students participated in the "Wild School Sites" program with the Kentucky Department of Fish and Wildlife and built bluebird boxes that serve as critical habitat for these sensitive creatures. After the high school students built the boxes, students from Lancaster and Campdick Elementary Schools helped to put them up in several locations. Garrard County will now likely see more of these wonderful birds in future years because the students acted on their concern.

Bird Decline Linked to Habitat Loss and Pollution

During the last decade, 52% of the 116 bird species surveyed in Kentucky were found to have decreasing populations (Figure 1). The most important factor impacting bird populations is loss or alteration of habitat. The loss of brushy areas, for example, is suspected to be contributing to the decline of field sparrows in Kentucky.

Many bird species found in the forest have declined due to the clearing and fragmentation of remaining forests. Some pesticides, such as DDT, are also believed to be responsible for the decline of many bird species including herons, egrets, ospreys, and eagles. The pesticide affected the ability of these species to reproduce. Several species of birds have been recovering slowly in Kentucky since the toxic pesticide DDT was banned in 1972.

Figure 1

Change in Kentucky Bird Populations, 1980–89

Species Increasing	% change	Species Decreasing	% change
Cattle Egret	+11.2	Little Blue Heron	–13.4
Cooper's Hawk	+6.1	Green-backed Heron	–5.2
Red-tailed Hawk	+5.2	Black Vulture	–8.7
Wild Turkey	+8.3	Sharp-shinned Hawk	–5.5
Pileated Woodpecker	+5.2	Rock Dove	–5.7
Eastern Phoebe	+5.4	Barred Owl	–5.2
Tree Swallow	+49.8	Gray Catbird	–9.3
Fish Crow	+19.0	Loggerhead Shrike	–8.6
Tufted Titmouse	+5.0	Blue-winged Warbler	–6.0
Carolina Wren	+23.4	Black-throated Green Warbler	–22.7
Eastern Bluebird	+10.6	American Red Start	–33.9
Cedar Waxwing	+20.5	Common Yellowthroat	–5.4
Blue Grosbeak	+10.1	Field Sparrow	–5.1
Song Sparrow	+5.1	Lark Sparrow	–5.4
House Finch	+25.2	Bobolink	–13.7
		Red-winged Blackbird	–5.0

Note: Selected species with at least a 5% change
Source: U. S. Fish and Wildlife Service Breeding Bird Survey, Kentucky 1990

Worksheet #1 continued

Increased protection measures and programs that release birds bred in captivity into the wild in an effort to increase their numbers are also contributing to the recovery of some bird species. The release of Ospreys on several lakes and rivers in Kentucky between 1982 and 1990 have resulted in six nests and 13 young.

Declines in some bird populations are partially explained by the introduction of non-native species which have overtaken the ranges of native birds. For example, the decline of the eastern bluebird and other cavity-nesting birds is attributed to competition with the European starling which was introduced in 1870.

Duck populations have decreased nationwide by approximately 50% since 1959. Inventories in Kentucky reveal that average duck populations were 70,000 in 1959, compared to 25,000 in 1990. The major reason for the decrease of waterfowl populations is the loss of wetlands where they breed in Canada and the U.S.

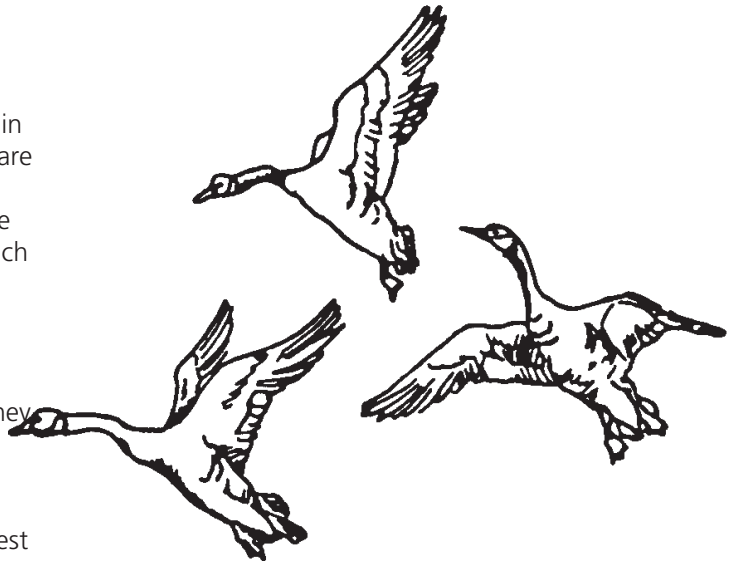
Greater Protection Efforts Needed

Many groups and individuals are working hard to reverse the decline of bird species by protecting and creating much needed habitat. Some groups, such as Raptor Rehabilitation in Louisville, accept injured birds and try to heal them with the hope of one day returning them to their natural environment. Student groups throughout the state are also making a difference by creating much needed habitat for birds.

Get to know the birds in your region and find out if they need <u>your</u> help. The list on the next page gives a brief description of some species in Kentucky and their habitat needs. There are many more species in the state and in your community.

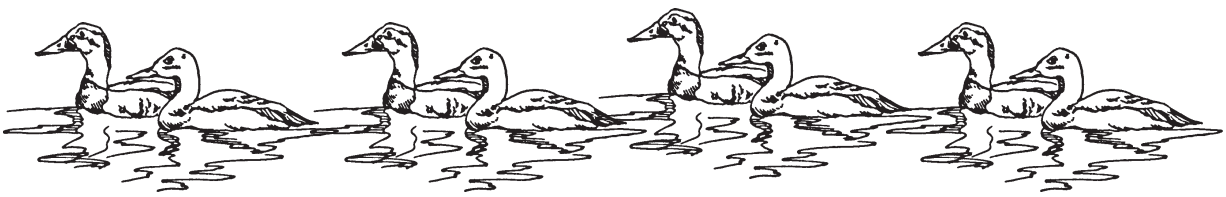
Questions?

1. What are the major factors impacting bird populations in Kentucky?
2. By what percent has the duck population declined in Kentucky between the years 1959 and 1990? What are the reasons for this change?
3. Which bird species experienced the greatest decline in Kentucky between the years 1980 and 1989? Which had the greatest increase in number? Suggest some reasons why these changes occurred based on the information provided for each species.
4. Have you ever seen a bald eagle or other bird of prey? List the ones you have seen and explain why they are called birds of prey.
5. What is your favorite bird? Why?
6. Do you think more should be done to protect declining bird species? Explain your answer and suggest what could be done in your community.



What You Can Do...

1. Report illegal hunting and poaching to the Kentucky Department of Fish and Wildlife. Call them toll-free at 1-800-252-5378.
2. Establish or protect habitat for the species that are decreasing in number due to adverse human impacts. This could include establishing a backyard wildlife area and putting up nesting boxes and feeders for the species you are most interested in attracting.



Worksheet #2

Selected Bird Species in Kentucky

Cattle Egret -
small, yellow-billed white egret. Seen in pastures where it associates with cattle and feeds on insects stirred up by their feet; often inhabits the borders of farm ponds.

Cooper's Hawk -
a crow sized, short-winged hawk with a long, rounded tail. Breeds throughout state, inhabits woods and woodland edges, nesting on limbs close to trunks of trees.

Red-tailed Hawk-
large-chested, broad-winged, red, round tail. Inhabits woodlands, parkland settings, often seen perched along interstates. Makes platform type nests, high in trees.

Wild Turkey -
large streamlined turkey with voice similar to domestic type. Formerly common forest species preferring open woodlands with an abundance of acorn and nut producing trees. Nests made on ground.

Pileated Woodpecker-
largest of the woodpeckers, red-crested. Makes large oval gouges in trees. Prefers dense forests, either upland or lowland type. Nests in trees at heights of 20-70 feet.

Eastern Phoebe -
medium, black-billed flycatcher with a "tail-wagging habit." Occurs in most habitats, whether settled or primitive. Will nest in man-made structures, under a bridge, culvert, porch, etc.

Tree Swallow -
small, greenish or blue-black swallow with clear white underparts. Occurs around impoundments, lakes, ponds, and other bodies of water, sometimes in huge flocks in late fall.

Fish Crow -
black, smaller than common crow with thinner bill, flocks with the Common Crow, various habitats.

Tufted Titmouse
small, gray, crested bird with rusty flanks. Occurs in every kind of forest except around mountain regions. Nests in cavities and will readily nest in artificial cavities and nest boxes.

Carolina Wren -
red wren with white stripe over eye. Breeds in primitive habitats and clearings. Occupies forest edges and all kinds of natural cover from swamps to woodlands. Nests in many places, even artificial situations.

Eastern Bluebird -
a small thrush which is found in open country and small clearings around woodlands. Will nest in natural or artificial cavity usually located 4 to 11 feet from the ground.

Cedar Waxwing
sleek, brown bird with a pointed crest, black mask and yellow-tipped tail. Prefers open country with scattered trees and shrubs usually avoiding dense woodlands. Nest located 8-60 feet above ground.

Blue Grosbeak -
stout billed, male is dull blue with 2 rusty wing-bars, female is brown with buffy wing bars. Favors streamside tangles of weeds and shrubbery, nests in tangle of weeds or low brush.

Song Sparrow-
medium size, streaked breast, with large central spot or blotch. Likes brushy situations, yards, gardens, overgrown fence rows, swampy ground, etc. Nests in shrubby, dense area on ground up to 5 feet.

House Finch -
medium, sized bird which is often seen in small flocks. Frequents urban areas, seen in large numbers at bird feeders. Introduced to the U.S. in 1940's and has quickly taken over territory of the purple finch.

Little Blue Heron -
small, dark heron. Immature is white with dark bluish bill. Inhabits shallow-water marshes, wetlands, upland meadows, sometimes seen near farm ponds, impoundments, or streams.

Worksheet #2 continued

Selected Bird Species in Kentucky

Green-backed Heron
small dark heron with greenish yellow or orange legs. Found in a variety of aquatic habitats, creeks, ponds, swamps, marshes. Generally seen singly but occasionally in groups of up to 30 birds.

Black Vulture -
encountered in semi-open areas, reported chiefly west of the Cumberland Plateau. Head is black rather than the reddish pink of the turkey vulture. Breeds along cliff lines and in abandoned buildings.

Sharp-shinned Hawk-
small short-winged hawk with a small head and long, square tipped tail. A bird of deep woods and woodland edges nesting 10 - 60 feet up in a crotch against the trunk of a tree.

Rock Dove-
also known as the common pigeon which frequents the city landscape. The bird adapts to a variety of habitats, particularly fond of man-made dwellings.

Barred Owl -
a large, brown owl found in forested bottomlands and ravines and swamps. Nests usually in the hollow of an old tree but occasionally will take over the nest of a crow, hawk, or squirrel.

Gray Catbird -
smaller and slimmer than the mockingbird, gray with a black cap and red-brown undertail. Prefers dense shrubbery whether in old fields, forests, or around houses.

Loggerhead Shrike
medium sized, big head, long tail, gray bird with black mask. Prefers open country with hedge rows and scattered trees; rarely seen in woods. Nest 5-12 feet above ground in dense shrub or tree.

Blue-winged Warbler-
small with 2 white wing-bars, forehead and underparts yellow, wings bluish. Prefers dry, weedy or brushy hillsides and shrubby woodlands.

Black-throated Green Warbler -
small bird, white spot on wing, bird of the mesophytic forests of East Kentucky, favors brushy undercover.

American Red Start-
small warbler that flicks its tail. Male is black with white belly and orange patches on wings. Female is olive brown above with white and yellow patches below. Inhabits woodland edges and overgrown clearing in mixed mesophytic forest, preferring moist areas.

Common Yellowthroat-
small warbler, olive-backed, yellow throat. A species preferring thickets and high weeds, at home in marshes, forest edges, overgrown meadows, and brushy stream banks.

Bobolink-
Male is black with white patches above and a yellow nape. Females are buffy and streaked. Likes open country habitats.

Red-winged Blackbird-
blackbird with red wing patches. A bird of swamp, marshes, ponds, and edges of waterways. Usually solitary but sometimes seen in small flocks.

Lark Sparrow -
small sparrow with distinct head patterns of chestnut, black and white. A grassland bird but can occupy rocky outcrops, erosion gullies, and other features with spare ground cover.

Backyard Bird Inventory Sheet

Name of Bird	Habitat	Brief Description of the Bird

Habitat-may include swamp/marsh, grassland, suburbs, forests, edgeland areas, clearings, bodies of water etc.

Activity 10. For Future Generations
Instruction Sheet

DO YOU KNOW. . .
- What a river otter looks like?
- Why river otters nearly disappeared from Kentucky?
- What you can do to help river otters and other wildlife?

River Otters Reintroduced Into Kentucky

Public perceptions about wildlife are sometime misunderstood and misdirected. Many Kentucky species have been greatly reduced in number because people do not understand their importance in the web of life or consider them a nuisance or threat. Examples of a native species that have all but disappeared in Kentucky are the black bear, the bald eagle, and the delightful river otter.

Fortunately, the Kentucky Department of Fish and Wildlife Resources has begun an exciting project to restore the otter in our rivers and streams. There is a great need for public education about the project and to build support for continuing releases of the otters until the animals develop a stable population in their natural environment.

Purpose:
In this activity you will help raise public awareness about the river otter and its continued restoration in our state. You will design a campaign, lesson, or exhibit on the river otter and the River Otter Restoration Program. This activity will enable you to play an important role in building support for protecting the river otter in our state.

Procedure:
Part I - River Otters and Their Environment

1. Obtain Worksheet #1 from your teacher. Review, discuss, and answer questions.

Part II - Organizing A Public Campaign

1. Develop a public outreach campaign regarding the program and the otters. The following suggestions (optional) will help you get started:

   A. Contact the Kentucky Department of Fish and Wildlife at the address listed below in "References" for more information about the Otter Release Program. The Department, as well as the Louisville Zoo, has river otters in captivity and will provide more information about the animals and the release program.

   B. Develop an Otter Week or set aside a week to recognize Kentucky's wildlife. Highlight important plants and animals of our state. Develop special activities each day in your school devoted to the River Otter and other rare species Develop a packet of crossword puzzles, games, etc.

   C. The following counties to date (1993) have received otters: Madison, Menifee, Greenup, Allen, Adair, Spencer, Harrison, Grant, Morgan, Carter, and Nelson County. If you have otters in your community, develop posters and pamphlets which provide information about the program to distribute to the public, schools, and the local library. Prepare an article for your school newspaper.

Other Activities:
1. Develop an educational unit to be taught to elementary students about the river otter and other rare plants and animals of Kentucky.
2. Research the habitat and needs of other wild furbearing animals by talking with the Kentucky Department of Fish and Wildlife Resources, sportsmen, and other knowledgeable people. Compare the differences in habitat requirements of other animals, highlighting how some species can adapt to urbanization and others cannot.

References/Additional Resources:
1. The Kentucky Department of fish and Wildlife Resources, #1 Game Farm Road Frankfort, KY 40601, 502-564-4762, has more information about otters, other wildlife, and how you can help to protect them.

Activity 10. For Future Generations
Worksheet #1

River Otters Returning to the State

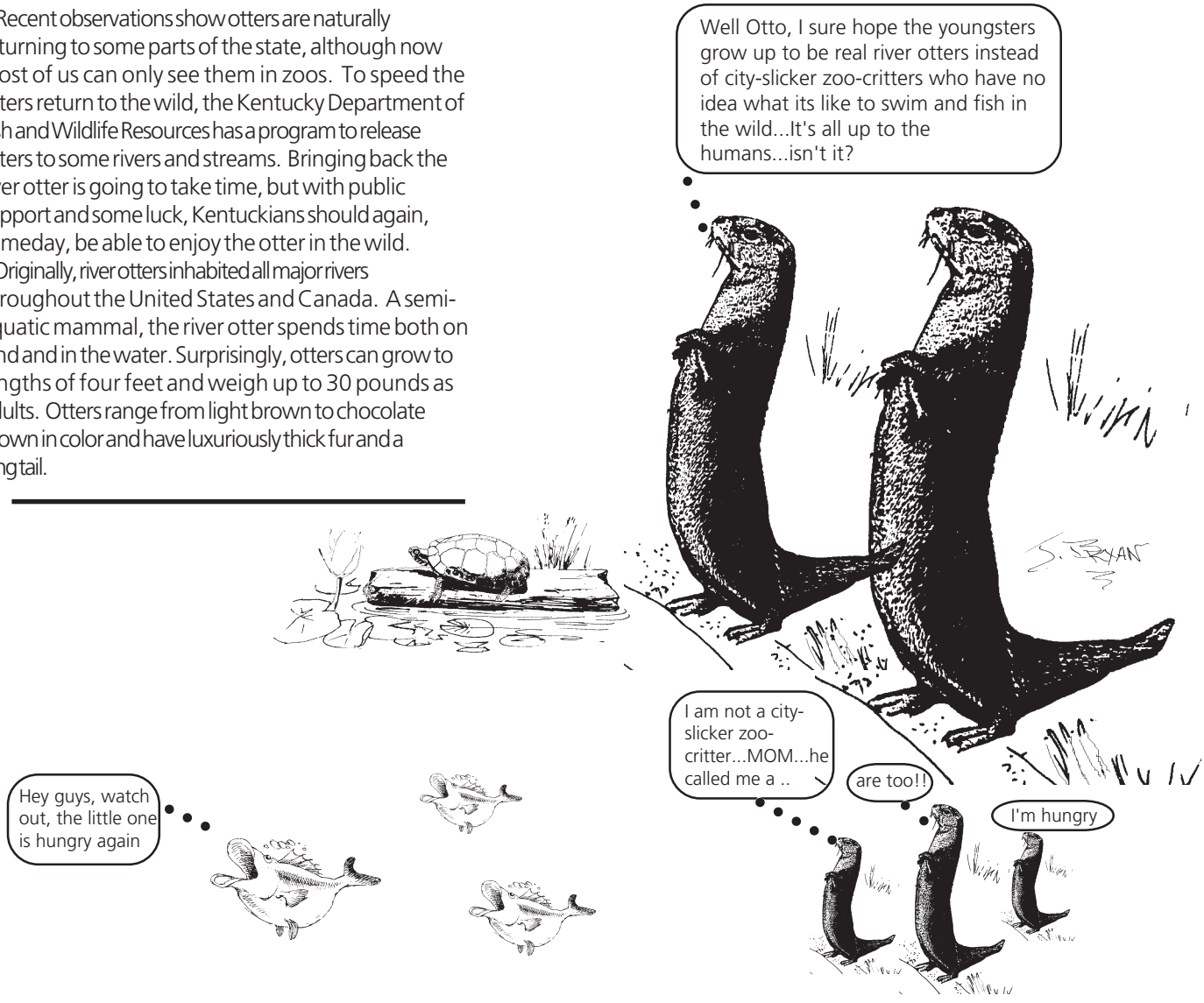
Few other native Kentucky furbearers are as appealing or genuinely entertaining in the wild as the North American river otter. The otter's graceful aquatic antics and natural activities offer pure enjoyment for anyone fortunate enough to see them.

Many people are acquainted with the river otter through television, wildlife displays, and zoos. However, observing otters in the wild has been very limited, primarily due to unregulated hunting and habitat destruction which have greatly reduced their numbers during the past century.

Another cause in the decline of the river otter is the loss of wetlands and the changing use of land in Kentucky. Many wetland areas have been drained for agricultural purposes, leaving fewer places for otters to live. Pesticides and chemicals have found their way into our waterways and contaminated the otter's food supply and environment. Fortunately, there are still many suitable areas in the state where river otters can survive and flourish.

Recent observations show otters are naturally returning to some parts of the state, although now most of us can only see them in zoos. To speed the otters return to the wild, the Kentucky Department of Fish and Wildlife Resources has a program to release otters to some rivers and streams. Bringing back the river otter is going to take time, but with public support and some luck, Kentuckians should again, someday, be able to enjoy the otter in the wild.

Originally, river otters inhabited all major rivers throughout the United States and Canada. A semi-aquatic mammal, the river otter spends time both on land and in the water. Surprisingly, otters can grow to lengths of four feet and weigh up to 30 pounds as adults. Otters range from light brown to chocolate brown in color and have luxuriously thick fur and a long tail.

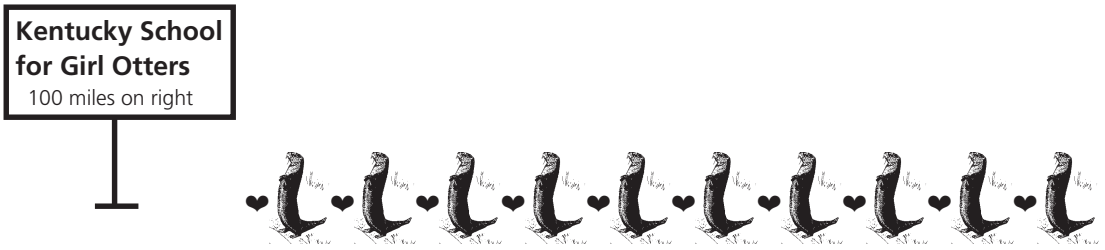


Worksheet #1 continued

A long time ago, river otter pelts were highly prized by fur dealers. In fact, otter fur was the standard by which other types of furs were measured. Unregulated trapping was one reason for the decline of otter across the continent. However, during the past 50 years the passage and enforcement of hunting and trapping laws and better wildlife management practices has allowed otter populations to increase. But the otters still need our help. Many states currently protect river otters and those states with populations high enough to sustain a harvest closely regulate trapping and hunting of this species.

River Otters Require Clean Water

Otters are generally solitary animals, except the period following the birth of the young, when the female and young are together. An average litter contains two or three young. Otters are considered a promiscuous species, with males traveling great distances to locate a receptive female during late winter and the early spring breeding season.



While many otters may occupy the same home range, they usually avoid each other by using scent to mark their territory. Sometimes, if a good supply of food becomes available, several otters may stay in one area. However, interaction among these animals is minimal.

Otters rarely make their own dens and rely on beaver lodges, overhanging banks, and other shoreline structures for resting areas. At times, otters will occupy a beaver lodge while beaver are still present. Otters primarily live on fish, crayfish, mussels, and crustaceans. They require clean, slow moving water with good cover, and an adequate fish supply. Pollution control efforts are helping to improve otter habitat, although more progress needs to be made to clean up Kentucky's waterways.

The distance between activity centers (areas where food, cover, and adequate water supplies exist) often determines the size of the otter's home range. With the exception of the male during breeding season, otters generally will not leave an activity center unless forced. Unlike many wildlife species, otters do not exhibit natural fluctuations in populations. Shifts in otter numbers can be directly attributed to man's influence on the otter or its habitat.

Worksheet #1 continued

Questions?

1. What factors led to the decline of river otters in Kentucky?
2. Do you think efforts should be made to restore the river otter in Kentucky? Explain your answer.
3. Do you think wildlife habitat should be protected even if it interferes with human activities? Explain your answer.

What You Can Do...

1. Clean water is critical to restoring river otters. Report suspected water pollution problems to the Kentucky Division of Water, 14 Reilly Rd., Frankfort, Kentucky 40601, 502-564-3410.
2. Support wildlife habitat protection efforts in your community.